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Probity in Public Life

IN the orgy of sensational disclosures now being made in Washington there is so much of speculation and fancy and so little of probability and fact that it behooves thoughtful citizens to derive a measure of reassurance from a little sober reflection. There are more than 100,000,000 people in the United States and the criminal record reveals the fact that a certain percentage of them are crooks of one form or another. But of the 600,000 employees of the government we believe it is safe to assume that the percentage of dishonest people is less than of the population as a whole. The processes of selection through which we choose our public servants and employees are calculated to eliminate many of the undesirable and unfit and to give us a general high standard of public service. And yet it is impossible to guarantee the probity of 600,000 men. The chances are that at any given time there is someone in some department of government employ who is indulging in graft or otherwise failing to maintain a high standard of integrity. It is likely also that if a mania for investigation were indulged at any time, some disclosures of rottenness would be made. Nevertheless the mere fact that a few subordinates go wrong is neither a cause for loss of confidence in the government as a whole nor a justification for the indiscriminate damage of reputations through the disclosures of witnesses who themselves are not entitled to unbounded confidence. When the smoke of political battle has cleared away, we shall doubtless find that the guilty are few in number and will be adequately punished and that the public interest has been protected.

The Annual Report Of the Steel Corporation

THOSE in the business world to whom the annual report of the United States Steel Corporation is the one accepted yardstick of industrial conditions must have found real encouragement last week in Judge Gary's optimistic array of facts and figures. Only twice in the corporation's history—in 1916 and 1917—has the total tonnage exceeded that of 1923. The average rate of operations for the entire year was 88.3 per cent of capacity, and during the first half of the year the rate averaged 92.6 per cent.

It may surprise some to learn that the 8-hour day, although heralded with disaster in some quarters, apparently failed to bankrupt the corporation. Instead, there appears to be every indication that it was accomplished with satisfaction to all concerned. Although data are not available to show definitely whether or not the efficiency of the individual worker has been increased, it is perhaps significant that with the 21 per cent increase in the total number of employees there was 42.4 per cent increase in ores mined, 51.5 per cent in coal mined, 42.3 per cent in coke manufactured, 39.1 per cent in blast-furnace production, 26.4 per cent in steel-ingot production and 24.9 per cent in the output of finished steel products. Furthermore, the common report that the 8-hour day had lowered the earnings of the average steel worker would seem to be refuted by the figures showing that the 260,786 employees in 1923 received an average of $5.83 per day, as compared with $4.91 for the 214,931 employees in 1922.

So much for the financial and industrial significance of the report. Some of our readers would doubtless like to ask the question, "What does the report show of technology, of the corporation's attitude toward research and technical development?" Unfortunately the answer is, "Nothing." Apparently we must appreciate the fact that such things aren't nearly so impressive to the stockholders as dividend appropriations and undivided surpluses. They can well be left for the engineers and metallurgists to talk about (in a guarded fashion) at their scientific meetings, though of course they must not be published for fear some one might be led to believe that the progress of technology had something to do with the steel business—and its future profits or losses.

Some of the Facts About Teapot Dome

NEWSPAPER reports are to the effect that the Senate oil committee's investigation is fast approaching a terminal. If this is true, a sigh of relief will go up from the entire country, even though the more important objectives which the committee could and should have accomplished are still unreached. The true merit of the policy underlying the oil leases, the necessity for offset wells to prevent drainage of the government reserves, the terms of the contract as compared with others now in effect—these are the points that the public wants settled definitely, once and for all. The least doubt as to the impropriety of the circumstances under which the leases were effected has long since ceased to exist.

Some light on the basic facts regarding the oil leases may be had from an engineer's impartial review, which appeared in *Engineering and Mining Journal-Press* for March 22, 1924. The author, H. A. Wheeler, consulting mining engineer of St. Louis, clearly shows that the first estimates of the richness of the Teapot Dome reservation were much too optimistic—that instead of a 200,000,000-bbl. yield present prospects point to an output of only 10,000,000 to 25,000,000 bbl. Of the total area of 9,300 acres, the geologists' estimate now shows that 5,600 are barren of oil or gas, 1,400 are gas bearing and only 2,300 acres are oil bearing. Of the oil lands, at least 1,600 acres that lie on the flank of the rich Salt Creek Dome have been subjected to drainage.

Referring to the leases themselves, Mr. Wheeler declares that the terms of the Sinclair contract (from the

government's viewpoint) were "decidedly superior to any private contract known to me." He explains that "the royalties are excessively high and the terms are very severe. For instance, the royalty under which about 90 per cent of the petroleum is produced in this country is one-eighth, but this applies in the Teapot lease to wells that average 50 bbl. or less per day. For wells averaging 50 to 100 bbl., the royalty is one-sixth; the royalty is one-fifth when 100 to 200; 25 per cent when 200 to 300; 35 per cent when 400 to 500; 40 per cent when 500 to 600; 42½ per cent when 600 to 800; 45 per cent when 800 to 1,000, and 50 per cent when the wells exceed 1,000 bbl. As many of the Salt Creek wells exceeded 1,000 bbl., the lease was extremely favorable to the government when executed before the comparative poverty of the field had been proved by drilling. . . . Now that drilling has indicated that Teapot is a lemon, it is not unlikely that the Sinclair company will be only too glad to be relieved of this white elephant, and any new contract will have to be made on a more favorable basis to attract oil operators."

Thus when the political fireworks are finally over and Messrs. Pomerene and Strawn have settled down to the orthodox but less spectacular legal processes of apprehension and conviction, there may yet be a number of new discoveries. One of them may be that except for its unearthing of political corruption, the oil committee's investigation has indeed been a tempest in a teapot.

Marked-Down Sales Of Chemical Services

SOME of us have had so much to say about the pressing need for improving the professional status of the chemist that the story is seldom repeated except in a gloomy tone of funereal seriousness. This is not the case, however, with one of our Cleveland friends whose contribution under the signature of "Chemical Steinmetz" appears on page 522 of this issue. In a very refreshing way he tells a would-be employer, who has advertised for an organic research chemist at a salary of $150, a number of surprising qualifications. Our friend's combination of messenger boy, graduate rubber chemist and Ford fixer makes his application very attractive, especially to a manufacturer who apparently has no appreciation of the professional services of the technical man. The advertisement in question bears all the earmarks of the familiar mossbacked organization, in which the chemist is regarded as a sort of vermiform appendix. To be sure, he occasionally comes in handy for advertising purposes, but usually he is a misunderstood and bothersome burden on the overhead. It is questionable, however, whether such a condition will ever be improved as long as there are chemists that will submit to it without protest and as long as there are a few manufacturers that do not realize that new technology points the way to progress and profits.

Another individual whose activities are a distinct handicap to the chemical profession is the pseudo-scientific consultant—the fellow that descends to the level of the charlatan to advertise his services on a fortune-telling basis. Such an individual is the "consulting chemist" of Boston, who uses the columns of the March *Scientific American* to attract any unwary customer anxious to have his "chemical problems solved and a working process furnished for Five Dollars." Just how broad is the gentleman's stock of problems and processes is not indicated, but we have the suspicion at least that most of them have to do with a certain post-Volstead service to bootleggers.

Any science or profession, particularly one as little understood and as mysterious to the layman as chemistry, is bound to attract the hanger-on and the quack—but it is a comforting commentary that at the present time there are relatively few in the chemical field. *Chem. & Met.* has had a hand in exposing a number whose fraudulent operations in the chemical engineering industries have brought large losses to the investing public. Doubtless there are others such as this Boston "consultant" whose activities may still lie within the postal authorities' definition of proper and legitimate business, even though they react most unfortunately on the standing of the chemical profession. Enterprising local sections of the American Chemical Society and other of our technical organizations will do well to investigate these cases to bring any evidences of fraud to the attention of the proper authorities and to use their influence in stamping out a degrading, disgraceful practice.

The Position of the Temporary Consultant

SEVERAL weeks ago we cited an instance of poor executive insight, where a manager, contemplating an improvement, called in an outside consultant, rather than utilize the ability of his own staff. The result was friction, waste and inefficiency in consequence of a lack of co-operation among the various units; and a sense of unfairness that arose because of the snub administered to regular employees. This was a specific instance, not a generalization; but a ventilation of the subject will serve to deflect attention in the direction of the important subject of staff relations, the harmony of which is as essential as it is among the other units of the organization.

In the instance cited one noted the antagonism between the regular staff and the consultant called in from outside the organization to do work that could have been done as well by those in closer touch with operations. There are instances, however, when the services of an outside consultant are needed, when history and the balance sheet indicate that the regular members of the staff are incapable of initiative or not endowed with sufficient perspective. In such event the executive in charge would act wisely in calling for outside help. The task of the consultant, however, is often made unreasonably difficult, and there is no justification for the jealousy and antagonism that sometimes greet his appearance in the plant, or for the obstructive tactics adopted by subordinates in an effort to balk him in carrying out his plans.

An engineer of broad experience once applied for a position in which he was expected to solve a difficult problem. "What do you know about the work?" he was asked. "Nothing," was the reply, "but your men have been so close to the job that they can't see the woods for the trees. By approaching the problem from a new viewpoint I believe I could solve it." And he did; much to the chagrin of those who were experienced and expert.

There is room in almost every chemical plant for men

of good fundamental education and broad experience —men with keen analytical perceptions, with minds that operate with a mental vigor that connotes engineering talent. Such men are available, but history shows that the suggestions they make are often side-tracked because they are not specialists in the subject. Herbert Hoover knew nothing about handling stranded refugees when he organized a small staff in London at the outbreak of the war and, by the introduction of engineering common sense, solved a problem that was beyond the power of the officials of the embassy or the consulate to cope with—in spite of their special training and experience. It is this sound engineering common sense that is needed in many of our chemical industries today. The reformer who is faced with the difficult task of reorganization, technical or economic, deserves whole-hearted support, not the opposition that springs from petty jealousy and lack of initiative.

Salaries of Postal Employees

SEVERAL bills are pending in Congress providing an increase in salary for postal clerks and carriers, and unusually great pressure is being brought to bear for the passage of one of these measures. On account of the close personal contact of postal employees with the public it has been exceptionally easy to arouse sentiment on behalf of this group of public servants, whose loyalty and dependability are proverbial. While sharing this sympathetic attitude toward fair pay for government employees, which we have always supported, *Chem. & Met.* believes that none of the pending bills should pass, for reasons that will be apparent on impartial examination. We do not oppose an increase in salary to postal employees where it is warranted, but we favor first the determination of several matters of fact: The cost of postal service in its several classes and the determination of just postal rates to meet that cost; comparison of rates of pay for postal clerks and carriers with those of private employees performing work of like character; comparison of cost of living for postal clerks and carriers in small and large communities; the ultimate cost of an increase in salary and the source of income to meet the additional expense.

Nobody knows the cost of postal service except in the aggregate; but by an exhaustive "weight and count" experiment in 640 post offices, the Post Office Department is now ascertaining the cost of handling first, second, third and fourth classes of mail, including parcel post. The studies have been made and the figures are now being compiled by a force of fifty men. When the data are finally available, the government will know what service it is now rendering at a loss and where an increase in postal rates would be justified to meet the deficit that is now made up by general taxation. Every class of mail should bear its cost of handling without discrimination, and rates should be charged that will yield the necessary revenue to cover the cost, including adequate pay for clerks and carriers. Coincident with this study is another one to ascertain the cost of living in different communities so that reasonable relief can be suggested for those employees that have to meet an exceptionally high cost of living.

With this brief review of the facts, it is apparent that it would be unwise at this time to pass legislation increasing the expense of the Post Office Department by as much as $150,000,000 a year without knowing where the money is to come from and without considering the relative merits of claims for relief in different parts of the country. The obviously wise thing to do is to postpone any legislation until the present studies have been completed. The results can then be used as a basis for recommendations that will be fair to all. Until the facts can be ascertained Congress should refrain from further complicating the situation by adding to the cost of operation of the Post Office Department.

The Gas Industry Is Responsible

EXCEPTION has been taken to our editorial on "Determining the Quality of Industrial Gas," published March 17, on the ground that we have misconstrued the gas industry's campaign for lower B.t.u. gas. In the hope and expectation of receiving further comment we shall withhold for a time publication of correspondents' views, with the assurance to representatives of the gas industry, official or private, that our columns are open for discussion of the subject. In the meantime it seems worth while on behalf of the gas-consuming industries to counteract the loose statements that have been advanced as part of the campaign to reduce the present B.t.u. value.

It has been claimed by gas company representatives that the heating value of a gas can be reduced without increasing the quantity of that gas used to supply the heat for a given operation. There is no justification for such a conclusion as a generalization. Indeed, the reverse is a well-established fact, especially for a gas used in industrial heating where the B.t.u. per cubic foot is a direct measure of its usefulness and value.

There have been sporadic attempts in the past to make changes in gas quality as a measure of economy in gas manufacture on the theory that lower heating value gas is "just as good." Of late these claims have been more numerous and there has been some evidence that even the associations and leading engineers of the industry are lending their support to this fallacious argument. In any event, unless the American Gas Association and the eminent engineers that direct its policy strike down this insidious propaganda at its source, they too must be held responsible for it.

It is well known that for many household purposes a gas of 10 per cent greater heating value does not always give a full 10 per cent greater service; but directly or indirectly in the long run the value is there for him that will use it. To reduce the heating value on the theory that wasteful methods do not always employ the richer gas quite as efficiently as the leaner would be to penalize the man that is careful. Furthermore, any such reduction in gas quality would result in a directly proportionate loss to industrial users that do employ the gas with high efficiency and that do find it valuable in proportion to its B.t.u. per cubic foot.

The chemical engineering industries are large users of gas. To them the gas industry can justify a lowering of quality without change in price only when it can be demonstrated that the present price is too low and that it is better to lower the quality than to raise the price. The gas industry must, if it is to command general industrial confidence, stand upon the basis of delivery of the maximum possible number of heat units per dollar total cost to its customers.

Practical Idealism in Industry

An Able Executive, an Engineering Pioneer, Who Is Creating a Personality for a Great Industry

Arthur Lowenstein

What is the matter with industry?

Save for the conservatively minded few, who invariably believe in status quo, everyone will agree that something is the matter. The question has become the universal cry of the thoughtful, and it is a protest against industry's machine-like march, its heartless disregard of the individual, its soullessness. Standing by the gate of a great industrial plant and watching the streams of men as they go in and come out, it almost seems as if the mill must be a malevolent giant growing strong on the life blood of its workers. What is the matter with industry? The answer is simple, though its ramifying causes are infinitely complex. Industry lacks humanity. It changes us into hopeless cogs or perverted money grabbers. The stern necessity of living standards adds its spur to the dollar chase. And the final touch should be added to this extraordinary picture of despair by crying, "What's the use?"

This gloomy view of things will not seem fair to those fortunate individuals endowed with mental health. There is a missing ingredient that modifies the depression and adds to it the color and warmth of enthusiasm, an enthusiasm that has vision of industrial progress in which the individual ceases to be a mere machine. This ingredient is an idealism that builds a practical Utopia. It is not an anemic Pollyanna that flies about saying, "Be happy," but a virile, constructive force that creates conditions compelling optimism.

It is such words as virility and optimism that should be associated with Arthur Lowenstein. Back in 1904 a young man entered the employ of a great packing company—Morris & Co.—as a chemist. A year later he was made chief chemist and then started a development in chemical engineering on the part of the company that was significant. Formerly it was solely a meat-packing plant. Patents began to be issued in the name of Arthur Lowenstein and corresponding plants were being erected, including improved deodorization of oils, hydrogenation, ammonia production, and so on. At the same time chemical control was being extended to the packing house department, and in 1914 he assumed the title of technical director. Later as consulting engineer he won distinction, and in 1917 he accepted the vice-presidency of Wilson & Co. As an executive with this company he has had technical control of the manufacturing operations of the company and supervised the purchase and sales of both raw and finished fats and oils.

These data may indicate the unusual degree of success that has followed Mr. Lowenstein's work, as a pioneer in chemical engineering, as an able organizer and executive, and as a man of great personal magnetism. But the picture is not yet properly painted, for there are many men that have achieved a deserved prominence in technical and industrial fields. Lowenstein has done more than that. As one of the prime movers of the Institute of American Meat Packers which was described in a recent issue of *Chem. & Met.*, he has been working to put into industrial work that missing element—humanity. He is not content with platitudes, but is translating the ideal into a practical plan, and he has given concrete evidence of his belief in it by founding a fellowship. The fellowship is created to investigate the causes of meat spoilage and the work will be carried out at the University of Chicago. This is a single unit in the scientific investigation of the tremendous problems of the meat packing industry, and this investigational work is again but one phase of the great plan of the Institute of Meat Packing. Yet the fellowship is a significant gesture—a concrete thing that indicates an attitude and a spirit. It is a spirit that cries: Let industry be more than a mere machine for the production of commodities and the payment of dividends. Let it become a force to develop the individual. Let it present the opportunity of realizing creative potential.

Extracting Potash From Russian Soil

The Development, Economics and Engineering of an Industry That Has Produced 20,000 Tons of Potash in a Year From Sunflower Stalks

By Joseph R. Minevitch and W. M. Malisoff
Consulting Chemical Engineers, New York City

> In the dim and distant past we learned that the Russians burned tons of wood to obtain ashes from which they extracted pounds of potash. This we were told was because of the expense of transporting German potash to Russia. Now comes this authentic story of the Russian potash industry enjoying a large export trade with its unique economics and primitive but effective technology. How much of the stuff that we learned in school is of that same kind?

THE Russian potash industry has its origins in antiquity. Its early development was entirely practical, uninfluenced by science and technology. Before the end of the nineteenth century industrial activities were found only as a casual occupation among the peasants in many parts of Russia. There were very few potash factories and the production of those that did exist was limited and primitive. The needs of the country were filled by home production. On account of the simplicity of the process and the small outlay required for the equipment for potash production, the early manufacture was largely in the hands of the peasant home-workers. At first home production was used to supply only the domestic needs, but gradually it developed into a selling industry as well and potash began to be manufactured for sale abroad.

In the early stages of the potash industry of Russia, potash was derived principally from the ashes of woody plants. As the forests were cut down and the wood was put to other uses, the wood originally available for ash-burning became scarce. The peasants then began burning for potash all sorts of plants and weeds, but largely pig-weeds, which possessed a high potash content. The lowest grades of potash were thus manufactured by the peasants. The potash had a maximum content of 60 per cent potassium carbonate and contained undesirable sodium and potassium salts in large amounts. Toward the end of the nineteenth century considerable attention was given to the utilization of sunflower stalks as a means of getting a steady and growing supply of potash. The center of potash production soon shifted to the provinces of Saratov and Voronezh in the south of Russia, where sunflower cultivation had already begun. In these provinces a group of small factories was established for the production of potash from the ash of sunflower stalks. Factory development began at this time and the manufacture of potash assumed for the first time a somewhat modern industrial character. The owner was usually a small entrepreneur and the workers were the one-time peasant manufacturers, who hired themselves out as foremen or ordinary workers.

Some time in the '70s of the last century sunflower cultivation was carried over into the Kooban province, in the southeast of Russia, where it thrived under naturally favorable conditions. The famine of the '90s and its subsequent crisis in the Saratov and Voronezh provinces caused a shut-down of the potash plants, and the industry was badly crippled. As a result the potash manufacturers centered their attention on the Kooban sunflower plantations and in 1893-94 two potash plants were built there.

The natural resources of the Kooban are most favorable for the industry. The abundance and low cost of fuel aided the industry quite as much as the sunflower cultivation. It is not a mere accident that the potash plants were concentrated in the Labinsk and Maikop districts. The tremendous forests furnished cheap fuel and packing materials.

Formerly Kooban sunflower stalks were used as fuel, but the great excess was burned in the open and the ash allowed to be wasted away by the action of wind and rain. The transfer of the potash industry to the Kooban caused a sudden, increased demand for the sunflower ash, and this forced the adoption of more efficient means of ash burning. The development of sunflower cultivation proceeded rather rapidly and it is at this time that the potash industry entered upon a new era of expansion. The needs of the internal market for potash were growing constantly and numerous factories had sprung up to supply the demand, both domestic and foreign. In 1917 the area under sunflower cultivation was 887,600 acres and from 1896 to 1917 the amount grown increased by 225 per cent.

Potash Production in Other Parts of Russia

While Kooban is the principal potash-producing province and the center of the Russian potash industry, the Saratov province is still a factor in the industry. The Saratov plants have a production capacity of about 15 per cent of the total potash produced in Russia. There are several other provinces engaged in potash manufacture. In these, however, the potash is not made from the sunflower stalks, but from other plants, grasses and straw, from which a low-grade potash is produced. This potash is, as a rule, consumed locally and has little influence upon the domestic and export markets. In the southwest, potash is obtained as a byproduct from the wastes of distilleries and sugar factories. The amount of potash produced annually as a byproduct is, however, very small. In 1917 the Central War Industries Board organized an enterprise to manufacture potash from

wormwood, which is found abundantly in the upper Urals and Troytzk. The ash from this wood yields a fairly high-grade product, with an 80 per cent potash content. The impending revolution and civil war brought further developments to a stop.

At the present time considerable agitation is going on in Russia against the wasteful methods of potash manufacture. Some scientists and chemists consider the sunflower utilization for potash production a terrible drain upon the rich Kooban soil, which is robbed of its natural wealth in potassium salts. Recent investigations show that Russia has abundant natural deposits of potassium-bearing minerals and the problem of rendering commercially available the enormous supply of potassium salts is now engaging the attention of Russian scientists, chemists and engineers, who also advocate the utilization of all byproducts from the sugar, malt and salt lakes for potash and potassium salts manufacture.

In the first decade since the establishment of the potash industry in 1893, the Labinsk and Maikop districts were rapidly covered by a network of plants. As the industry concentrated, the new plants were put up in less favorable districts. With a single exception, the further development of the industry was kept within the confines of the "fertile" sunflower plantations and was not pushed elsewhere, because of the comparatively smaller areas of sunflower fields, small yields of ash and high price of fuel.

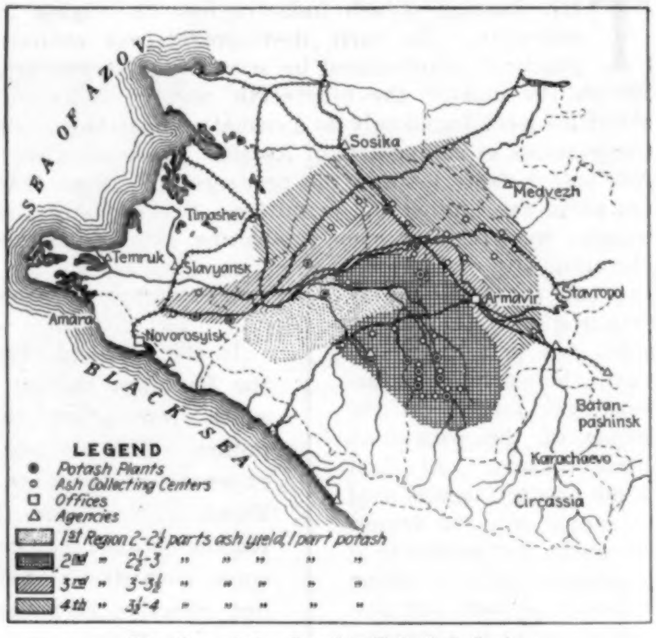
Analysis of Producing Units

In 1910 this development fever abated and at the same time there appeared signs of lack of co-operation between the plants and the regions serving them. The shortage of raw materials and the sharp competition caused the entire industry to assume new forms of organization. The result of this was the creation of the large corporation of Caucasian chemical factories, uniting in itself twelve potash plants. This led to further concentration of production and the transition to the modern type of chemical plant. Following this, the large Armavir factory was constructed by the "Salomas" corporation. Up to that time twenty-four potash plants existed in the Kooban and were distributed as follows: Labinsk district, nine plants; Maikop, nine plants; Ekaterinodar, four plants; Kavkaz, two plants.

The plants cannot be accurately classified as small-scale or large-scale producing units, since the entire production of potash was small-scale, differing only in degree. Items such as quality of potash produced, type of fuel used and mechanical equipment installed cannot be used as criteria of differentiation, but the plants can be classified according to the number of employees. The following table presents some illuminating data:

Type of Plants	No. of Plants	Total No. Workers	Average No. Workers	Quality Potash Per Cent K_2CO_3	Yearly Capacity Tons	Per cent, Total Capacity	Annual Ash Consumption	Lb. Ash Per Lb. Potash	Power, Hp.
Up to 25 men....	9	151	17	88–90	3,960	15	11,880	3.00	none
From 25 to 50...	13	454	35	90–96	16,380	61	48,420	2.96	105
From 50 men up.	2	163	81	92–94	5,760	24	19,080	3.31	32
Total.........	24	768	32	.....	26,100	100	79,380	3.04	137

The plants of the first group are of little significance. The potash produced by them is low-grade, containing both sulphate and chloride impurities. They have no mechanical improvements, all the work is done by manual labor and their combined annual production amounts to only 15 per cent of the total in Kooban. The second group of plants may be termed "type" plants. These are most numerous, producing guaranteed and high-percentage potash. The average production per plant is about 1,300 tons per year, two of them having a production capacity of 1,800 tons each of potash per year. Most of them are equipped with mechanical pumps for the transfer of water and chemical liquors, and being located in the most favored regions for the collection of ash and fuel, they represent a combined production capacity of 63 per cent of the total. The two plants in the third group are large plants. The Armavir plant has excellent mechanical and power installations and burns oil as fuel. Work at these plants is continuous, with well-arranged shifts, and the number of workers employed is fairly large. They have a combined production of 22 per cent of the total per year.



Location of the Russian Potash Industry

The production capacity of all plants is about 26,500 tons of potash, for which would be required 80,000 tons of ash. The largest amount of ash ever collected amounted to only 58,000 tons, a figure considerably below the capacity of the Kooban plants. Because of insufficient raw materials several plants, principally those of the first group, have shortened the working season. In 1910 the Caucasian merger of chemical plants caused many of the small plants to shut down, strengthening thereby the position of the larger ones. In other words, economic necessity dictated a reorganization in accordance with the real possibilities of the region. The accompanying curves show the trend of Russian potash production and export. The peak was reached in 1912, when almost 20,000 tons of potash was produced.

The average cost of production in peace times was about \$36 to \$42 per ton, which was distributed as follows:

		Per Cent of Total Cost
Raw materials, ash	\$24.80	66.6
Fuel	4.15	11.1
Labor	2.75	7.4
Packing	1.65	4.4
Administrative	3.90	10.5
Total per ton	\$37.25	100.0

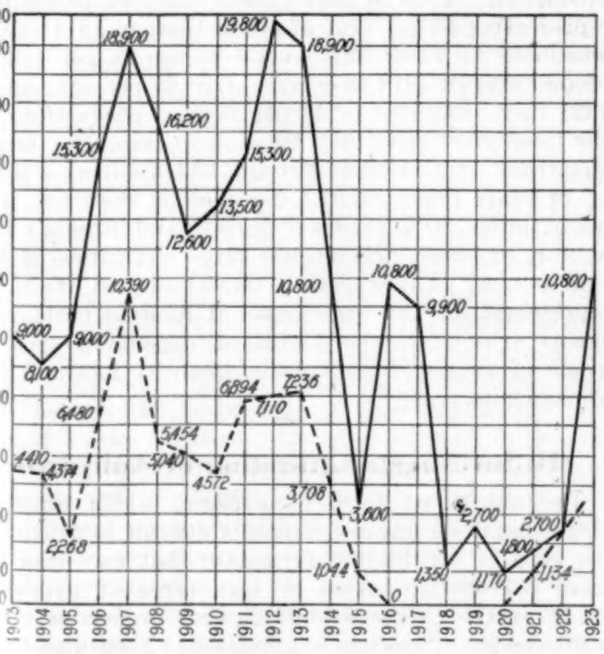
The cost of the ash is obviously the largest item. The market price of the ash fluctuated between \$8.25 and \$11 per ton and sometimes reached even higher levels. The other items entering into the cost of production remained approximately steady. The average market price of potash in peace times ranged as follows:

	Per Ton
Potash, less than 90% K_2CO_3	\$44 to \$50
Potash, guaranteed 90 to 92% K_2CO_3	50 to 55
Potash, highest grade, 92-96% K_2CO_3	55 to 69

Plants producing high-grade potash accumulate for sale the potassium sulphate and chloride, which are removed from the potash during the purification stage. Usually the separation is up to 5 per cent K_2SO_4 and up to 3 per cent KCl.

The Technique of Production

The harvesting of sunflowers usually begins during the first days in August and ends in the middle of September. If the weather is quiet and without wind, the burning of the stalks takes place at the time of the harvest. The fire is made on prepared ground and the stalks are thrown into the fire all day long. Practice has shown that stalks dried too thoroughly burn rapidly, yielding thereby an ash of poor quality. When the burning is slow, without flame, and the heap allowed to smoke lightly, there is a greater yield of ash and its quality is greatly improved. Wind likewise affects the quality and yield of ash. It makes difficult the control of the desired slow burning and causes appreciable losses. As a rule burning is avoided in high winds; and when the stalks are too dry, they are burned at night. In general, night burning is preferred to day burning. After complete combustion, the ash is allowed to cool



Production and Export of Potash in Russia, 1903-23

sufficiently and is shipped as soon as possible to the factory or nearest ash storehouse. The average yield of ash is from 160 to 190 lb. per acre. Quite frequently, however, the yield is about 265 lb. ash per acre, especially when the stalks come from fresh land in the nearby forests.

The burning of sunflower stalks and the production of potash is widespread throughout the whole of the Kooban province, with the exception of a few isolated districts. The amounts of stalks burned varies widely with each district, depending largely upon the storage facilities for the crude potash. For instance, in the Labinsk and the Maikop districts as much as 75 per cent of the available stalks supply has been utilized; in the Caucasian 50 per cent, and in the Ekaterinodar only 30 per cent. In 1903, 21,800 short tons of ash was collected. The annual production increased constantly, until in 1912 is reached about 58,000 tons. Subsequent statistics show a gradual decline in production and in 1919 only about 16,300 tons was collected. In most prosperous years the annual collection exceeded 55,000 tons. Some of the potash plants were able to store up more than a whole year's supply of ash from one season's crops. The amount worked up depended not only on increased area of cultivation but also on the amount of stalk burned and on yield per acre.

Yields and Quality of the Ash

In burning the sunflower stalks, that portion of the potassium which in the plant is combined with organic acids is converted to the carbonate. The final ash contains the carbonates, sulphates, phosphates, chlorides and silicates of sodium, potassium, magnesium, iron, etc. The years of experience of the planters, now confirmed by numerous laboratory tests and investigations, enabled them to classify the various stalk-producing regions according to the content of potash, sulphates and chlorides in the ash. This classification was of importance to the potash producers, as it aided them in the preparation of higher grades of potash and in cheapening production. The potassium carbonate content varies according to the ash from 25 to 50 per cent. A pound of 90 to 92 per cent potash is obtainable from 2 to 4 lb. of ash. The "fertility" of the various regions has been classified as follows:

Region	Territory	Lb. Ash Per Lb. Potash
1	Maikop, along the Kooban River	2—2.5
2	Upper Maikop and part of Labinsk	2.5—3
3	Part of Taman, Krasnodarsk and Caucasus	3—3.5
4	Part of Labinsk and Caucasus	3.5—4

The potassium sulphate content in the ash does not fluctuate to any appreciable extent. The potassium chloride content, however, varies with the districts. It has also been found that the quality of the ash varies with the year, and these variations are sometimes considerable. The following is a detailed analysis of a typical ash from the sunflower stalks:

	Per Cent		Per Cent
K_2O	36.28	P_2O_5	2.5
Na_2O	0.8	Cl	3.19
CaO	18.54	Sand	9.33
CO_2	21.36	Moisture	5.26
SiO_2 (combined)	1.47	Inorganic residue	1.19
S	0.08		
		Total	100.00

Extraction of Potash

The process and the equipment employed at the potash plants are very simple. The process is divided into several operations: (1) extraction of the ash, (2) evaporation of the extract, and (3) ignition or bleaching of the potash. The extraction is carried on in wooden or iron pans. The pans have double bottoms, the upper portion of which has a row of small holes through which the extract trickles. The extraction liquor, of definite concentration, then passes through heating tanks, where it is evaporated down to 50 deg.

Bé. or higher. As the liquor concentrates, the potassium sulphate separates out and is removed from the alkaline liquors by means of special traps. The quality of the potash is thus considerably improved. At the plants where the better grades are produced, the liquor after boiling is cooled in special tanks or underground pits. This cooling leads to another purification of the liquors by the removal of deposited sulphates and chlorides, making possible a very high-grade potash. The completion of the process takes place when the product passes to the potash kilns. In some plants the product is sent through preliminary driers. In these kilns all the water is evaporated off and the organic constituents are burned out, leaving a clear white potash. The Kooban factories prepare the following grades:

Grade	K_2CO_3 Content, Per Cent	Grade	K_2CO_3 Content, Per Cent
1	89—90	3	92—94
2	90—92	4	94—96

The 88 to 90 per cent potash is principally used for domestic consumption. The three other grades are exported as guaranteed products.

Russian potash is usually packed and shipped in barrels, weighing 500 to 575 lb. These barrels have twelve oak hoops and before shipment from the country two steel hoops are put on the ends. The inside of the barrel is lined with special waterproof packing paper to preserve excess moisture absorption. In shipping, nevertheless, water is absorbed to the extent of one and one-half per cent. It has come to the attention of the writer that Russian potash is now being exported to the United States. Arcos-America, the agent for Russian potash producers, has been selling significant quantities in the United States for the last 2 years.

Present Status of the Potash Industry

The production of the Kooban potash plants at the time of the war dropped considerably and recovered slowly when potash became necessary for the production of potassium nitrate and the cyanide for poison gas. The entire activity of the plants during the war was regulated by the Central War Industries Board. The revolution of 1917 and the civil war which followed, especially fierce in the Kooban, brought the plants almost to a complete standstill. During this period of warfare and the industrial reconstruction that followed, several potash plants were completely abandoned as unfit and several were dismantled in order to rebuild other plants. The present status of the potash plants can be described as follows:

Status of Plants	No. of Plants	Production Capacity, Per Cent of Total
Fully equipped for production	8	41
Needing substantial improvements	6	16
Totally unfit for production	10	43

The above information indicates the extent of the destruction of the industry during the civil war. Reconstruction is proceeding rather slowly and considerable additional equipment is needed to put the potash plants on a sound, economic basis.

The supply of sunflower ash appears to be plentiful for the present, sufficient to meet the needs of production. According to statistical data for the current year, 540,000 acres of sunflower was cultivated, from which the potash plants expected to collect about 27,500 tons of ash and to produce over 10,000 tons of potash. The maximum production of the present plants is approximately 60 per cent of their pre-war capacity, and every effort is being made to work them up to this limit. Plans for new developments have been formulated and the post-war and revolutionary period will be followed by an expansion similar to that which characterized the pre-war growth of the industry.

Characteristics and Marketing of Russian Potash

At the time of Peter the Great the export of Russian potash was a government monopoly. The peasant producers would sell their product to the government agencies, which in turn sold it through a central office to foreign buyers. Exports continued to grow until 1880, when they noticeably declined, principally on account of the manufacture of potash in Germany. Exports came to a standstill until 1900, when, aided by the new developments in the Kooban region, Russian potash again assumed an important place in the foreign markets. Kooban potash is known in foreign countries as Caucasian potash and on account of its high quality was able to compete with the German-made product. Aside from its cheaper cost, Caucasian potash is practically "sodium-free," which is considered another advantage. The following is a comparative analysis:

	Russian Potash, Per Cent	German Potash, Per Cent
Potassium carbonate	92.2	91.34
Sodium salts	0.4	5.35
Chlorides	2.6	traces
Sulphates	1.2	none
Insolubles	0.8	0.68
Water	2.8	2.53

Russian potash exports average about 50 per cent of production. Thus in 1907 Russia exported 10,500 tons, representing 55 per cent of production; in 1911 exports amounted to 7,000 tons, representing 45 per cent of production; in 1913 they were only 33 per cent and in 1921 they amounted to 63 per cent of production. Of the countries importing Russian potash, the largest quantities went to great Britain, which during a period of 14 years imported 27.5 per cent of the total. Germany, although a producer herself and Russia's competitor, imported nevertheless large quantities of Russian potash. Large potash importers had their own representatives and warehouses at Russian ports. The export price of potash fluctuated, depending upon the grade of potash, freight costs, quantity lots and time of payments.

To Investigate Utilization of Anhydrite

The anhydrous form of gypsum, which occurs in large quantities in some mines, is difficult to utilize. In the hope of obtaining information that may lead to a more efficient utilization of such types of gypsum, a study of the chemical and physical properties of the whole series of calcium sulphates has been undertaken by the Department of the Interior at the Non-Metallic Minerals Station of the Bureau of Mines, New Brunswick, N. J. The bureau will attempt to determine (1) the stability of gypsum and anhydrite in their relation to gypsum ore reserves and (2) the properties of anhydrite in their relation to better utilization. A preliminary study has been made of physicochemical work that has already been accomplished bearing on this subject. Samples of anhydrite and gypsum have been obtained from gypsum mines.

The Case of Cresylic Acid: A Tariff Anomaly

How a Change in Assessing Duties Has Affected Composition and Properties of This Commodity

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> Commercially cresylic acid is a highly important commodity of indefinite composition. It enters into the manufacture of a wide range of industrial products. Since the passage of the tariff act of 1922 there has been a striking change in the composition and properties of the imported material. The reason for this, as convincingly shown by Mr. Davis, is to be found in the new law's attempt to differentiate between free and dutiable material solely on the basis of distillation range. The editorial "A Tariff Problem of Many Angles," *Chem. & Met.* pp. 420-1, March 17, 1924, calls attention to the economic injustice of the present method of enforcing the duties.

CRESYLIC ACID as imported into this country principally from England and Germany is one of the most complicated of the products derived from the distillation of coal tar. The variation in composition and quality depends largely on the kind of coal carbonized, the method of carbonization and the degree of heat employed in the manufacture of illuminating and heating gases, these factors having direct action on the grade of tar produced during the operations and consequently upon the products derived from its distillation. The composition of cresylic acid also depends a great deal on the methods and care employed in its extraction from the coal-tar oils containing it and its subsequent distillation.

Crude cresylic acid as extracted from coal-tar oils is a dark, somewhat sirupy liquid, which contains besides cresylic acid a varying amount of water, phenol, xylenols and higher boiling bodies—the so-called phenoloids. Subjected to distillation, most of the water and entrained oils are removed and a pale cresylic acid is obtained. The residue remaining in the still varies from the consistency of a heavy sirup to soft pitch. This is usually disposed of in such ways as prove profitable to the manufacturer. The pale cresylic acid so obtained, if the distillation has been carefully conducted and not carried too far, is a clear, somewhat sirupy liquid of pale to deep straw color. It contains a small percentage of water, more or less traces of oils, the three isomeric cresols in varying proportions, some xylenols, a small percentage of naphthalene and occasionally a little pyridine. The odor is not at all pleasant, as the distilled acid is contaminated with sulphuretted hydrogen and sulphurous acid held in solution.

In the manufacture of cresylic acid when sulphuric acid is used to decompose the sodium cresylate there is no doubt some sulphonation, particularly if strong sulphuric acid is used as is sometimes done to hurry the process, with the result that the whole liquid becomes quite hot. When there is any sulphonation, there will be a splitting off of the sulphonic acid group on distillation, which will enter into solution with the distilled cresylic acid, giving it the objectionable "sulphur odor" so frequently noticed in the commercial product. Careless use of sulphuric acid in the decomposing operation (sometimes called "springing") and inattention to proper washing previous to distillation are other causes of this odor.

The objectionable contaminations described can be practically removed by blowing air through the whole distillate, an operation that may take 2 or 3 days before the desired result is obtained.

The distilled or "sweetened" acid ready for the market, however carefully the operations have been conducted, is seldom if ever of a uniform grade, for when tested by distillation conducted in accordance with the recognized official methods, the yields are found generally to vary at certain stated temperatures, the variations frequently being quite wide. A good cresylic acid on such a distillation will yield at least 90 per cent of distillate between 195 and and 230 deg. C., showing it to be composed practically of at least 90 per cent isomeric cresols and xylenols, which are its valuable constituents.

It is pretty well known by users of cresylic acid that it is, or rather should be, mainly a mixture of ortho cresol, meta cresol and para cresol in varying proportions. All three of these isomers possess the same chemical formula, C_7H_7OH. They vary particularly in specific gravity, boiling and solidifying points, which will be considered in detail further on.

Ortho cresol, when chemically pure, possesses a specific gravity of 1.036 at its melting point, equal to 1.0516 at 15.5 deg. C. as compared with water at 15.5 deg. C. It boils at 191.8 deg. C. and solidifies to a colorless, crystalline mass at 30.1 deg. C. It is more poisonous and less effective as an insecticide or germicide than the two other isomers, neither is it of value for the production of synthetic resins. It follows, therefore, that a low-boiling cresylic acid is not of great value to manufacturers of high-class liquid disinfectants.

Meta cresol, chemically pure, has a specific gravity of 1.0387 at 15.5 deg. C. It boils at 202.1 deg. C. and when entirely free from moisture will crystallize at 12 deg. C. It is much less poisonous than ortho cresol and it possesses high germicidal properties. The higher the proportion of meta cresol in a commercial cresylic acid the better it is for germicidal preparations. This fact is recognized in the pharmacopœias in directing the method for preparing liquor creosolis compositus, which aims at insuring the presence of as much meta and para cresols as possible, particularly of the former.

Para cresol, chemically pure, has a specific gravity of 1.0388 at 15.5 deg. C., boils at 202 deg. C. and crystallizes at 36 deg. C. It is somewhat less poisonous than the ortho and meta cresols and possesses high germicidal properties but not to the same degree as the meta form.

Xylenol. The xylenols are derivatives from xylol (dimethyl toluol), the next higher member of the homologous benzol series. Theoretically there are six isomeric xylenols, but only two, or perhaps three, are found in coal-tar distillates. Some of them have been isolated and studied, with the result that when chem-

ically pure they are shown to be crystallizable, the solid crystals melting at temperatures ranging from 61 to 75 deg. C., boiling at from 210 to 225 deg. C. and possessing specific gravities from 0.973 to 1.028 at 15.5 deg. C.

The known xylenols are found in much greater proportion in oils distilled from blast-furnace tar than in ordinary coal tar. They appear to be more abundant in tars obtained from the carbonization of cannel coal, Scotch coals and lignite. Xylenols, as we shall presently note, constitute most of the "high-boiling cresylic acids" that are imported for the manufacture of high-coefficient disinfectants, indicating that their germicidal properties are of a powerful character.

Creosol and xylenol, although exhibiting weak acid properties, as seen by their ready chemical combination with alkalis and the rendering of litmus paper slightly red, are not really organic acids; they are, in fact, heavy alcohols, as shown by their formulas. They all have a sweetish taste accompanied by a burning sensation and are more or less poisonous. Handled with ordinary care, they are are not dangerous, but as "familiarity breeds contempt" it is well to remember that the cresols and xylenols as well as ordinary cresylic acid will cauterize the skin in the presence of moisture, but will not do so in the presence of an oil such as linseed oil.

Changing Composition of Commercial Product

With regard to the quality of cresylic acid imported into the United States during the past 15 years the following records of tests will show the great variation in composition during that period, caused mainly by the necessity of manufacturers and exporters for distilling and compounding in order to insure freedom from duties imposed by the several tariff acts of recent years. To many these duties do not seem just, since for the crude product we are practically dependent on shipments from abroad, because only a fraction of the quantities required for domestic manufacturing operations are produced in this country.

All the following tests were made in practical accordance with the method prescribed by the New York customs appraisers' laboratory and are as nearly as possible typical of the 2,000 or more that have passed through my hands during the past 15 years.

From the distillation tests shown in Table I it will be observed that there was considerable variation in composition, particularly as regards the 190 deg. point. The tariff act of 1922, however, contained some very definite specifications as regards the free and the dutiable cresylic acids. Paragraph 27 of the dutiable list contained the words "all distillates of coal-tar, blast-furnace tar, oil-gas tar and water-gas tar . . . which on being subjected to distillation yield in the portion distilling below 215 deg. C. a quantity of tar acids equal to or more than 75 per centum of the original distillate." On the other hand, paragraph 1549 of the free list provided for "all other distillates of any of these tars which on being subjected to distillation yield in the portion distilling below 190 deg. C. a quantity of tar acids less than 5 per centum of the original distillate." As soon as this tariff bill became a law the foreign manufacturers and exporters realized that in order to insure continued free entry of their products they must adapt them to conform within the limits thus set. To accomplish this many changes were made in the manufacturing and compounding in order that both the 190 deg. and 215 deg. points should be met. In working out a method for producing duty-free cresylic acid, the writer was consulted by the importers and tests were made of a number of proposed mixtures. While it is impossible at this time to mention the various components that were tried out, it is interesting to note the changes in distillation tests as shown in Table II, based on samples submitted late in 1922.

Table I—Character of Cresylic Acids Imported From 1910 to 1922

Sp. Gr. at 15.5° C.	Percentage Distilling Below 190°	195°	200°	205°	210°	215°	220°	230°
1.042	4	7	63	95	..	..	..	..
1.048	12	26	88	90	97	..	..	..
1.043	5	10	45	74	87	..	..	..
1.043	0	5	32	71	87	96	..	..
1.040	0	5	22	64	82	87	93	96
1.047	20	37	73	81	89	..	..	..
1.047	7	14	50	82	93	..	..	..
1.049	16	56	84	94	99	..	..	..
1.046	3	7	49	77	88	95	..	..
1.043	5	27	71	90	96	99	..	..
1.037	4	5	36	72	88	95	99	..
1.052	12	52	95	..	..	..	..	..
1.038	..	..	14	16	58	83	91	..
1.053	5	22	79	90	..	..	..	..
1.050	8	27	84	95	..	..	..	..
1.044	2	..	6	52	76	87	91	95
1.044	..	2	35	79	93	97	..	..
1.051	..	3	56	88	96	..	..	..
1.056	3	17	45	74	88	93	96	..
1.053	..	1	21	59	80	95	..	..
1.037	3	..	12	53	71	83	93	..
1.047	2	3	6	41	68	82	89	93

Note. The 190° point gives yield of "water and oils."

Table II—Distillation Tests on Cresylic Acids Imported During the Latter Part of 1922

Sp. Gr. 15.5° C.	Percentage Distilling Below 190°	195°	200°	205°	210°	215°
1.044	2	5	36	55	69	80
1.098	11	43	60	67	70	73
1.047	..	6	22	40	53	68
1.059	2	4	27	45	59	69
1.037	10	36	64	76	80	82
1.065	3	28	49	62	68	72

Table III—Character of Present Importations of Cresylic Acid

Sp. Gr. 15.5° C.	Percentage Distilling Below 190°	195°	200°	205°	210°	215°
1.042	3	6	27	46	60	72
1.039	..	1	2	25	54	71
1.034	1	2	3	5	35	60
1.043	..	1	6	37	59	74
1.039	..	2	13	43	63	74
1.039	..	..	2	23	49	71
1.044	..	..	3	33	58	73
1.038	..	..	2	17	46	70

Table IV—Character of High-Boiling Cresylic Acids

Sp. Gr. 150.5° C	Percentage Distilling Below 200°	210°	220°	230°	240°	250
1.041	..	4	15	39	53	65
1.032	..	6	43	66	79	..
1.040	3	10	44	60	70	76

Finally a method was selected for the production of a grade of cresylic acid that could be imported so as to meet the tariff act requirements for free entry and at the same time not to interfere with the various industrial products into which it enters. The tests in Table III of imported products will show how well this has been carried out by European exporters. These tests are typical of the large number of shipments examined during 1923 and 1924.

"High-boiling" cresylic acids are coal-tar acids especially manufactured for the production of high-coefficient disinfectants. They are derived mainly from blast-furnace tar oils and are composed principally of xylenols. This is clearly indicated by the tests in Table IV which show their general constitution.

The usual test for high-boiling acid is that it shall yield a distillate of not more than 2 per cent at 210 deg. C., 10 per cent at 215 deg. C., 50 per cent at 230 deg. C. and 70 per cent at 240 deg. C. Some manufacturers of high-coefficient disinfectants require a yield of 30 to 35 per cent at 235 deg. C.

Table V—Character of Still Residues

Sp.Gr. 15.5 ° C.	Percentage Distilling Below 200°	210°	220°	230°	240°	250°	260°	270°	280°	290°	300°	Residue
1.085	4	24	58	72	78	82	..	..	..	92	..	Pitch
1.121	22	42	57	64	68	69	72	77	81	..	..	Pitch
1.077	12	22	31	41	50	62	..	..	..	..	86	Pitch
1.069	3	23	55	69	75	78	80	85	..	..	..	Pitch
1.072	5	32	54	65	70	73	..	77	..	..	90	Pitch

Notwithstanding that high-boiling acid was extracted from coal-tar oils by means of caustic soda solution, the imported product when tested for solubility in three times its volume of caustic soda solution (sp. gr. 1.150) frequently shows between 5 and 15 per cent of insoluble oils.

Referring to the manufacturer's distillation of the extracted crude cresylic acids Table V will show about the constitution of the residue in the still when the distillation is ended.

Crude cresylic acid residues were primarily part of the crude cresylic acid as extracted by caustic soda solution, yet it is found that 15 to 20 per cent of it is insoluble when shaken with twice its volume of 20 per cent caustic soda solution.

It is somewhat difficult to form a definite opinion as to the actual constitution of imported cresylic acids in relation to the isomeric cresols and xylenols. My experience has shown me that it is pretty safe to take the percentage distilling from 190 to 200 deg. C. as ortho cresol and that from 200 to 210 deg. C. as meta and para cresols. From 210 to 240 deg. C. may be taken as the percentage of xylenols. This may not be exact, as there may be some variable differences in the overlapping of the fractions, but it closely approximates exactness and it may prove of value at least for comparative work.

Steel Treaters Standardize Terms

Definitions Relating to Heat-Treatment Operations Tentatively Approved by Committee on Recommended Practice

During recent years, heat-treatments have become more and more complicated, and as a result there has arisen certain confusion in regard to the meaning of commonly used terms. For instance, in one locality or trade, any operation of heating and cooling resulting in a softening of the material is being called annealing, whereas in other places to "anneal" means not primarily to "soften" but to heat to above the "critical temperature" and to cool very slowly. Similar confusion as to the meaning and application exists in regard to other terms, and as a result "annealing," "tempering," "normalizing," etc., are being used by different persons to mean widely different things.

In any attempt accurately to define the terms commonly used in connection with heat-treatment, the first question to decide and the most important one is: Do the terms relate to the heat-treatment operation itself or to the results obtained by the treatment? In other words, is the term indicative of the structure or the condition obtained or of the operation performed?

After careful consideration, it appears most logical and most in keeping with present-day usage to have the terms so defined that they shall mean definite operations and shall not be considered as referring to the structures or general conditions resulting, although in a great majority of cases the structures or conditions resulting may be quite similar.

At first glance it would appear entirely unnecessary to coin any new words. It seems, however, that one of the reasons for the confusion that has come to exist is the lack of adequate terms with which to express the different operations and conditions met with. In suggesting the use of the term "loneal," an attempt is made to relieve the term "anneal" of some of the misuse which it suffers and to eliminate the term "draw," which has such wide application in regard to the mechanical operations performed on metals as distinct from thermal treatments.

In commercial practice the terms here defined will vary slightly depending upon the material under consideration. A "relatively slow rate of cooling" does not mean the same thing for an alloy steel as for a plain carbon steel, but the general meaning of the terms should remain the same regardless of material being treated. This must necessarily be the case if the term relates to the actual operation and not to the structure or the condition resulting from the operation.

Heatings and coolings, during any part of which steel is worked mechanically, are excluded from the meanings of the terms here given.

By "heating," as appearing below, is meant a thorough and uniform penetration of the heat.

By "critical temperature," as appearing below, is meant that temperature which is customarily associated with the following phenomena:

(*a*) Hardening when quenched.
(*b*) Loss of magnetism.
(*c*) Absorption of heat.
(*d*) Formation of solid solution.
(*e*) Pronounced refinement of coarse grain upon cooling.

Heat-Treatment Definitions

1. *Annealing*. Heating above the "critical temperature" followed by a relatively slow rate of cooling.

2. *Loneal*. Heating below the "critical temperature" followed by any rate of cooling.

3. *Normalizing*. Heating above the "critical temperature" followed by an intermediate rate of cooling.

Note—In good practice, the heating is considerably above the "critical temperature."

4. *Spheroidizing*. A long-time heating at or about the "critical temperature" followed by slow cooling throughout the upper part of the cooling range.

Note—For the purpose of spheroidizing the cementite in high-carbon steels.

5. *Hardening*. Heating above the "critical temperature" followed by a relatively rapid rate of cooling.

6. *Tempering*. Reheating, after hardening, to some temperature below the "critical temperature," followed by any rate of cooling.

7. *Carburizing*. Adding carbon, with or without other hardening elements, such as nitrogen, to wrought iron or steel by heating the metal below its melting point in contact with carbonaceous material.

8. *Casehardening*. Carburizing the surface portion of an object and subsequently hardening by suitable heat-treatment.

9. *Cyaniding*. A specific application of carburizing where the object, or a portion of it, is heated and brought into contact with cyanide salt.

A Survey of Products That Afford

Industrial Outlets for Chlorine

Technical and Economic Position of Bleach, Liquid Chlorine and Carbon Tetrachloride and Their Significance to Producers of Chlorine

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IN A PREVIOUS article (*Chem. & Met.*, vol. 28, No. 19, p. 846, May 14, 1923) an attempt was made to outline present economic conditions and tendencies in the chlorine industry. It was pointed out at that time that the chlorine manufacturer was of necessity a manufacturer of chlorine products as well. From a modest beginning as a producer of bleaching powder, the chlorine manufacturer has extended his domain by the diligent and persistent development of various chemicals until his list of products now includes as its more important items, liquid chlorine, carbon tetrachloride, chloroform, chlorides of such metals as aluminum, zinc, tin, antimony, iron, silicon and titanium; chlorides of sulphur, phosphorus and arsenic; hydrochloric acid, permanganates, and various organic compounds such as benzyl chloride, benzaldehyde, benzoic acid, the chlorbenzols, ethylene dichloride, trichlorethylene, acetylene tetrachloride, methyl and ethyl chlorides, and chloracetic acid. So far as the industry in the United States is concerned, practically all of this development has come within the past 20 years, and a very large percentage since 1915.

If it were possible to collect and correlate the results of the research work conducted by the various companies engaged in the manufacture and sale of chlorine, an important and highly interesting chapter might be added to the history of chemical engineering development. However, a policy of laborious secrecy has prevented the publication of most of this work, and the growth and expansion in the industry must be judged largely by the physical constants of market reports. Some information has found its way into print in the patent literature and in reports by independent investigators. It is the purpose of this article to collect and summarize the principal contributions to the literature of the chlorine industry during the past 5 years.

Bleaching Powder

Bleaching powder manufacture deserves first consideration by virtue of its age and its relative importance as a chlorine product. Production of bleaching powder in the United States started in 1897 with the establishment of the Dow Chemical Co., at Midland, Mich., and the Castner Electrolytic Alkali Co., at Niagara Falls, after a duty of $4 per ton on bleaching powder had been fixed by the tariff act of 1897. Table I includes data on domestic production and imports of bleaching powder from 1899 to 1920 and the approximate average wholesale price for each year. The production and import figures are from government census and tariff information publications, and the price data for this and other chlorine products have been taken for the most part from market reports in *Chem. & Met.* and in the *Oil, Paint & Drug Reporter.*

A general outline of the chamber process and of the mechanical chlorinator process of manufacture has already been given. Regarding the mechanical chlorination, Ditz[1] has stated that the quality of the bleaching powder produced is influenced by the concentration of chlorine in the incoming gas mixture and by the presence of water. The most favorable chlorine concentration is given as 10 to 12 per cent for bleaching powder of 36 to 37 per cent available chlorine. The diluting air serves to moderate the reaction velocity and to conduct away the heat of reaction. The slaked lime used should contain from 5 to 6 per cent excess water, which serves to cool the reaction mixture by its evaporation. More water than this favors lumping of the bleach and consequent incomplete chlorination. Carbon dioxide in the chlorine gas mixture seems to have a more deleterious action in the mechanical chlorinator than in bleach chambers. The decomposition of bleaching powder by CO_2 is favored by high temperature and the presence of water.

Table I—Production, Import and Price Data for Bleaching Powder

Year	Domestic Production, Lb.	Imported, Lb.	Average Price, Cents Per Lb.
1899	21,958,000	113,107,250	2.11
1904	39,176,000	99,085,386	1.37
1909	116,802,000	83,399,660	1.53
1912	....	72,706,732	1.42
1913	....	76,092,327	1.33
1914	310,380,000	48,497,239	1.59
1915	....	18,402,130	1.75
1916		3,289,790	7.75
1917		65,564	3.86
1918		540,131	3.38
1919	252,850,000	341,812	2.37
1920	....	488,395	4.38
1921	168,774,000	Not available	2.50
1922	....	....	2.00
1923	....	....	1.85
1924	Contracts	....	1.25

Calcium Hypochlorite as Bleach

Pistor and Reitz, in U. S. Patent 1,236,978, disclose an interesting process which had been patented in Germany at an earlier date. It consists in preparing crystalline calcium hypochlorite, $Ca(OCl)_2$, by treating a mixture of hydrated lime and not more than 1.5 times its weight of water, with chlorine at a pressure of 500 mm. water, or 0.7 lb., above atmospheric. The temperature of the mixture during chlorination is to be kept at 35 to 45 deg., and the chlorination is continued until only a small amount of $Ca(OH)_2$ is left. From the resulting concentrated solution calcium hypochlorite crystallizes out and may be separated by filtration and dried in vacuo to a powder. It should be remembered in this connection that the bleaching properties of bleaching powder are due to its oxygen content rather than its chlorine; so that pure $Ca(OCl)_2$, having two oxygen atoms per molecule, equivalent to four chlorine atoms,

would show on analysis, and in bleaching, an available chlorine content of 99.24 per cent, even though its actual chlorine content is only 49.62 per cent. The German patents claim a product containing from 80 to 90 per cent available chlorine. In addition to this high bleaching strength, the dried powder is said to be very stable and readily soluble. According to Michaelis,[2] in 1919 the Greisheim Electron works was manufacturing a product known as "Hyporit," an almost pure $Ca(OCl)_2$, containing more than 80 per cent available chlorine, a little $CaCl_2$ and a very little lime. The powder readily dissolved in water to form an almost clear, very faintly alkaline solution which could be used in place of Dakin solution.

Along the same line the Greisheim Electron Co. in 1921 obtained British Patent 182,927, covering the production of compounds of calcium hypochlorite and calcium hydroxide. These double compounds are to be stabilized by washing to remove $CaCl_2$ and by subsequent drying at temperatures up to 110 deg. either in vacuo or at ordinary pressure. The product should contain from one to four molecules $Ca(OH)_2$ per molecule $Ca(OCl)_2$, is claimed to be almost unaffected at elevated temperatures, has a higher percentage available chlorine than bleaching powder and possesses only a faint odor.

With a chlorine capacity greatly in excess of present consumption, the chlorine producers have been turning their attention to outlets for chlorine with great energy. This article forms part of an extensive survey that has been made to reflect for the readers of *Chem. & Met.* the present status of this work.

Subsequent issues will contain additional parts of the survey that has enlisted all available sources of information and focused them with the aid of extensive experience in this field.

Liquid Bleach Advantageous

In districts where the bleach consumer and manufacturer are close together it has been found to be mutually advantageous to market the bleach in solution, prepared by the chlorination of milk of lime. This eliminates a large percentage of the usual handling and storage charges for the consumer, who has merely to pump the solution from tank cars to a storage tank, and dilute to the proper strength as needed; it also eliminates a large initial equipment investment for the manufacturer, since a small and compact chlorinating apparatus has a very considerable capacity. Proper temperature control and a good grade of lime are the prime considerations for successful operation. Solutions containing as high as 15.75 per cent by weight available chlorine have been prepared and shipped on a commercial scale. McMahon in U. S. Patent 1,426,752 discloses a process of chlorinating milk of lime with gaseous chlorine derived from liquid chlorine, the heat of reaction being used to supply the heat of vaporization of the liquid chlorine by passing the liquid chlorine through a coil immersed in the solution prior to its introduction as a gas into the solution.

A number of articles have been published on the subject of decomposition of bleaching powder. Losses on standing have been found to be slight but appreciable. At higher temperatures, such as 100 deg. F., loss is rapid, all available chlorine being exhausted in a short time.

Liquid Chlorine

In spite of the importance of liquid chlorine in the industry, the technical literature of the past 5 years contains very little information as to its production. The latest development, outlined in U. S. Patent 1,472,294, is the liquefaction of chlorine at pressures of 10 to 15 lb. such as are readily reached in practice. This is made possible through the working out of a new refrigerating medium, ethane, which makes temperatures of —75 deg. C. attainable. Bartlett, Snyder and Wells,[3] and Max Mauran[4] have discussed the hazards and the means of transportation of liquid chlorine. The use of 1-ton and 15-ton containers has become quite common since 1918.

While census data for 1914 indicate that liquid chlorine was being made in this country at that time, it has been quoted on the open market only since 1916.

Carbon Tetrachloride

Carbon tetrachloride has become a very essential product of the chlorine industry, although the quantity of chlorine absorbed in its manufacture is comparatively small.

The various processes of manufacture used at the present time are modifications of the general reaction of chlorine on carbon bisulphide to form CCl_4 and sulphur chloride, with subsequent decomposition of the sulphur chloride with an excess of carbon bisulphide to form CCl_4 and free sulphur. Thus Strosacker[5] adds CS_2 to sulphur bichloride in a still, distilling off the CCl_4 produced until the residue in the still is principally a solution of sulphur in hot sulphur chloride. A further quantity of sulphur bichloride is then added, and bisulphide addition is continued until the reaction again reaches the sulphur-in-sulphur chloride stage. Finally by raising the temperature and adding more CS_2, a residue consisting chiefly of molten sulphur nearly free of sulphur chlorides is obtained and drawn off from the still.

Table II—Liquid Chlorine Production and Price Data

Year	Production (Short Tons)	Approx. Average Price, Cents Per Lb
1914	6,108	.....
1916	......	15.00
1917	......	16.00
1918	......	9.75
1919	17,196	7.00
1920	......	8.40
1921	18,105	8.25
1922	......	5.44
1923	......	5.40
1924	Contracts car lots	3.00

Japanese Patent 32,030 describes a process of passing chlorine under pressure through CS_2, and conducting the resulting vapors through a cooling coil and a tower containing manganese and aluminum chlorides, and returning the mixture of CS_2, CCl_4 and S_2Cl_2 to the original vessel.

Baillio[6] discloses a process resembling Strosacker's. He passes free chlorine into a mixture of CCl_4 and S_2Cl_2 until a substantial portion of the sulphur chloride is converted to sulphur bichloride. Sufficient CS_2 is added to this mixture to convert a large percentage of

Table III—CCl_4 Production and Price Data

Year	Production, Lb.	Approx. Average Price, Cents Per Lb.
1916	....	17.19
1917	....	16.21
1918	....	18.00
1919	9,811,779	11.94
1920	....	12.56
1921	5,406,995	10.51
1922	....	10.05
1923	....	9.50

the sulphur bichloride present to S_2Cl_2 and to form CCl_4. After separating the CCl_4 thus formed, the residue is treated with chlorine as before to form sulphur bichloride. Just how the increasing volume of sulphur chloride is taken care of is not clear.

Ochi[7] conducted a series of experiments on the chlorination of CS_2 with chlorine gas in the presence of various catalysts. His procedure was to pass the chlorine through the CS_2 contained in a vessel provided with a reflux condenser. He concluded that antimony and iron chlorides were the best catalysts, with chlorides of manganese and aluminum next best. When antimony trichloride was used, the conditions for the best yield were: temperature 30 deg., weight $SbCl_3$ from 0.5 to 1.0 per cent of that of the CS_2 used and 145 per cent of the theoretical amount of chlorine. He also tried the chlorination of CS_2 with sulphur monochloride and found that when 1 molecule of CS_2 was treated with 3 molecules of S_2Cl_2 in the presence of 3 per cent of various catalysts, Sb_2S_3, FeS and iron powder, and the mixture boiled for 5 hours, only 40 to 45 per cent of the chlorine was converted to CCl_4, an intermediate compound, $CSCl_2$, being formed. This result does not agree with large-scale results obtained in this country and may have been due to some factor peculiar to the small scale on which the experiment was run.

Ochi found that nickel resists the reaction mixture CCl_4-S_2Cl_2 best, with amalgamated lead second choice. Pure lead, copper and iron are attacked to some extent. He also reports that CCl_4 containing more than 6 per cent CS_2 is flammable.

Natural gas has been suggested as a base material for CCl_4 and the intermediate chlorination products of methane by Gardner and Clayton[8] and by Jones, Allison and Meighan.[9] A smooth and regular chlorination is effected by passing a mixture of natural gas with chlorine through charcoal, first at a low temperature and then at a temperature of about 300 deg. C. The HCl formed is absorbed, and the reaction products are condensed. For production of CCl_4, the temperature in the reaction zone should be kept at 300 to 400 deg. The degree of chlorination is dependent on the rate of flow of the gas mixture, a slow feed favoring complete chlorination. A small amount of moisture in the gas seems to be essential. So far is is known, no attempt has been made to apply this process on a commercial scale.

The principal applications of carbon tetrachloride are as a solvent and as a fire extinguisher. In the solvent field, CCl_4 has a handicap in its high specific gravity and high cost per pound compared to gasoline, benzol and carbon bisulphide. Its main selling point is its non-flammability. Where the cost of the pure solvent makes its use of questionable economy, some degree of safety may be had by blending a flammable solvent with CCl_4. Thus the statement is made[10] that to be reasonably safe from fire hazard

55° naphtha should contain not less than 30% CCl_4
63° naphtha should contain not less than 45% CCl_4
70° naphtha should contain not less than 50% CCl_4
76° naphtha should contain not less than 70% CCl_4

These mixtures will burn if spread on readily combustible material and cannot be recommended except when the use of CCl_4 is not possible.

Along the same line Sievers and McIntyre[11] have found in a series of very careful experiments that a mixture of 70 per cent by volume CCl_4 and 30 per cent benzene, and a mixture of 65 per cent CCl_4 and 35 per cent gasoline are non-flammable. They found that on distillation these mixtures fractionate to some extent, so much so in the case of gasoline that the mixture becomes unsafe. For entire safety where distillation is necessary, 28 per cent benzene and 72 per cent CCl_4 should be used.

Ochi[12] has compared the extractive power of CCl_4 with that of CS_2, gasoline and ether on soya beans, and has found that CCl_4 is equal or superior to ether and gasoline, but is usually inferior to CS_2. Water does not seem to affect the extractive power of CCl_4 as much as it does that of the three other solvents.

Carbon tetrachloride is said to be somewhat corrosive, especially in the presence of water, to iron, lead and copper, but not to aluminum.

As a fire extingusher carbon tetrachloride has too high a freezing point (—10 deg. F.) to be safe at all seasons in a temperate climate. To overcome this objection, a certain percentage of some other compound is added to make the carbon tetrachloride fire extinguisher of commerce. Mork[13] patents three compounds:

1. CCl_4............95 per cent by volume
   Chloroform, 5 per cent, with addition of 2.5 grams of triphenyl phosphate and phenyl salicylate per 100 c.c.
2. CCl_4............92.5 per cent by volume
   Chloroform 2.5
   Safrol 5.0
3. CCl_4...........90.0
   Chloroform 5.0
   Pine oil 5.0

Strosacker[14] proposes the use of CCl_4 mixed with 5 to 10 per cent methyl chloride or methyl bromide; while Louder[15] makes the rather startling proposition of adding 10 per cent carbon bisulphide to lower the freezing point.

Fieldner, Katz, Kinney and Longfellow[16] studied the decomposition products of CCl_4 when used as a fire extinguisher. They found that the extinguisher breaks down to some extent into phosgene and small amounts of chlorine and hydrochloric acid; and that the decomposition products are present in sufficient quantities to be toxic when the extinguisher is used in a confined space. For incipient and open fires it is highly recommended and is especially suited for fires around electrical equipment because of its non-conductivity.

This dielectric property has led to the suggestion[17] that CCl_4 be used in electrical transformers to replace oil. In this way the fatal explosions that occasionally occur in transformer stations could be avoided. Urban and Scal[18] found that when an electric arc was caused to break in CCl_4, there was intense liberation of chlorine.

Carbon tetrachloride has recently found a place in medicine as a remedy for the hookworm disease. Hall[19] reports that experiments performed on thirty dogs indicate that CCl_4 is more effective than any of the commonly used drugs. Only a pure and carefully refined CCl_4 should be used for this work.

(Other outlets for chlorine will be discussed in a subsequent issue.—EDITOR.)

LIST OF REFERENCES

[1] *Z. anorg. allgem. Chem.*, vol. 102, pp. 66-80.
[2] *Münch. med. Woch.*, vol. 66, p. 45.
[3] *Chemical Age* (N. Y.), vol. 29, p. 397.
[4] *Transactions*, American Institute of Chemical Engineers, June, 1922.
[5] U. S. Pat. 1,204,608.
[6] U. S. Pat. 1,260,622.
[7] *Journal of Chemical Industry* (Japan), vol. 22, pp. 877-90.
[8] U. S. Pat. 1,262,769.
[9] U. S. Bureau of Mines Technical Paper 255.
[10] *Drugs, Oils & Paints*, vol. 33, pp. 441-2.
[11] *Chem. & Met.*, vol. 26, p. 603.
[12] *Journal of Chemical Industry* (Japan), vol. 22, pp. 1067-77.
[13] U. S. Pats. 1,246,640, 1,246,641 and 1,246,642.
[14] U. S. Pat. 1,261,067.
[15] U. S. Pat. 1,430,745.
[16] *Journal Frank. Inst.*, vol. 190, pp. 543-65.
[17] *Electrical Review*, vol. 77, pp. 889-90.
[18] *Compt. rend. de l'academie des sciences*, vol. 168, pp. 887-9.
[19] *Journal of Agricultural Research*, vol. 21. No. 2, pp. 157-75.

Metals for Use in

Handling Organic Solvents

Action of Acetone and Methanol on Metals Used in Chemical Engineering Equipment

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IN THE course of a survey of chemical literature relating to hardwood distillation and products obtained therefrom, it was observed that there was very little knowledge respecting the action of acetone and methanol upon various metals and alloys that are in industrial use. It was thought that this information would prove of value as a source of data that could be utilized by manufacturers of these metals and alloys and also by consumers of acetone and methanol, and therefore a series of determinations was made. Twenty-two samples of ferrous and non-ferrous alloys and metals were collected, along with authentic statements regarding their composition (see Tables I and II), and the tests described in this paper were then carried out.

The samples were cut to suitable dimensions, polished to remove etchings, cleaned with ethyl ether to remove grease and dirt, measured and weighed.

Tests Made at Room Temperature

These tests were carried out by suspending duplicate samples by cords in the solvent contained in a well-stoppered 200-c.c. wide-mouth glass bottle. The solvent in these bottles was changed every 2 weeks over the entire period of immersion of 6 months.

At the end of the test period, the samples were removed, cleaned by brushing with a small stiff-bristled brush, washed with ethyl ether and reweighed.

Tests Made at Boiling Point

In each of these tests duplicate pieces were suspended on glass hooks in an underwriters' extraction apparatus which contained the solvent. The apparatus was heated as in a usual extraction, thus exposing the metal samples to the hot vapors of the solvent. These tests were conducted over a period of 30 days, at the end of which time the samples were brushed, cleaned and reweighed.

The acetone used was of the best commercial grade and possessed the following characteristics:

Specific gravity	0.797 at 15 deg. C.
Permanganate test	60 minutes
Acidity (CO_2)	0.0014 per cent
Alkalinity	Nil.
Residue	Nil.

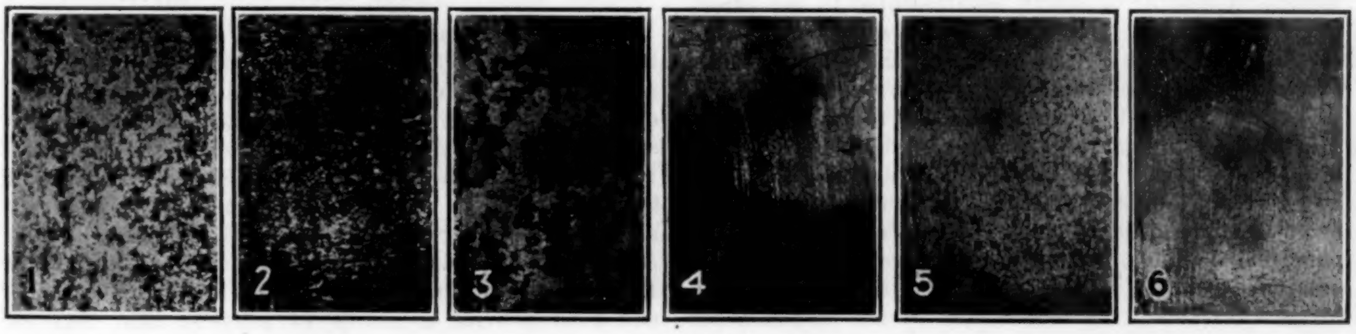

Fig. 1

Immersed in Methanol at Room Temperature
1. Aluminum 2SO (pure soft sheet)
2. Aluminum-manganese alloy 3SO (soft sheet)
3. Aluminum 17SO (alloy soft sheet)

Exposed to Hot Vapors of Methanol
4. Aluminum 2SO (pure soft sheet)
5. Aluminum-manganese alloy 3SO (soft sheet)
6. Aluminum 17SO (alloy soft sheet)

The methanol employed was also of the best commercial grade and had the following properties:

Specific gravity	0.7965 at 15 deg. C.
Tralles	99½
Acetone	0.015 per cent
Esters	Nil.
Color	Water-white.

The gain or loss of the various test pieces was calculated to the gain or loss in milligrams per square decimeter. The results of the determinations are presented in Table III.

Non-Ferrous Metals Investigated

Very little, if any, corrosive action was exhibited with either acetone or methanol by any of the non-

Table I—Percentage Composition of Non-Ferrous Metals Tested

	Copper	Zinc	Tin	Nickel	Aluminum	Lead	Cadmium	Iron	Manganese	Silicon	Magnesium
Aluminum 2SO (pure soft sheet)	0.12	......	......	......	99.24	......	......	0.33	Trace	0.31	......
Aluminum-manganese alloy, 3SO (soft sheet)	0.14	......	......	......	97.81	......	......	0.55	1.17	0.33	......
Aluminum 17SO (alloy soft sheet)	4.00	......	......	......	95.00*	......	......	......	0.50	......	0.50
Cr and a rich gold	89.90	9.97	......	......	......	0.05	......	0.08	......	......	......
Cr and a copper	99.95	......	......	......	......	......	......	......	......	......	......
Cr and a low brass	79.45	20.5	......	......	......	0.02	......	0.03	......	......	......
Cr and a aluminum bronze	92.09	......	......	......	7.83	......	......	......	......	0.08	......
Admiralty bronze	70.00	29.0	1.0	......	......	......	......	......	......	......	......
Phosphorus bronze, 4 per cent	96.00	......	4.0	......	......	......	......	......	......	......	......
Phosphorus bronze, 8 per cent	92.00	......	8.0	......	......	......	......	......	......	......	......
Hy-Ten-Sl bronze†	......	......	......	......	......	......	......	......	......	......	......
Manganese bronze†	......	......	......	......	......	......	......	......	......	......	......
Tuc-Tur metal	63.02	22.41	......	14.27	......	0.02	......	0.28	......	......	......
Monel metal	28.00	......	......	67.00	......	......	......	3.5	1.00	0.50	......
Nickel	......	......	......	99.00‡	......	......	......	......	......	......	......
Nickel alloy, 20 per cent	75.00	5.00	......	20.00	......	......	......	......	......	......	......
Zinc No. 13	......	99.94	......	......	......	0.05	......	0.01	......	......	......
Zinc No. 53	......	99.29	......	......	......	0.35	0.35	0.01	......	......	......

* Aluminum plus impurities.
† Exact composition unknown.
‡ Remaining 1 per cent consists of copper, iron, manganese, silicon and carbon.

Table II—Percentage Composition of Ferrous Alloys Tested

	Total Carbon	Graphitic Carbon	Manganese	Phosphorus	Sulphur	Silicon
Open-hearth steel	0.100	.....	0.380	0.011	0.042	0.010
Bessemer steel	0.070	.....	0.360	0.085	0.045	0.009
Wrought iron	0.029	.....	0.046	0.135	0.020	0.113
Cast iron	2.786	2.700	0.380	1.110	0.064	3.520

ferrous metals, except with methanol on aluminum alloys, and then only where exposed to the liquid at room temperatures over an extended period of time. The same metal samples exposed to the hot vapors of methanol seemed to develop a protective coating that inhibited corrosion to a great extent (see Fig. 1). This phenomenon was evident to a somewhat less degree in the case of the other non-ferrous metals tested, although the corrosive action therein was practically negligible.

Heinzelmann (*Z. Spiritusind.*, 1905, vol. 28, pp. 368-89) observed that aluminum was attacked by commercial wood-spirits, which he attributed to the esters present. However, similar corrosive action was noted by the present writer with methanol which contained no esters. Rudiger and Karpiriski (*Z. Spiritusind.*, 1912, vol. 35, pp. 660-61) concluded from their work with ethyl alcohol that aluminum was suitable for stills, but not for vessels in which the alcohol was to be stored. The writer is of the opinion that while aluminum is acted upon by alcohols (methanol and ethanol) at ordinary temperatures, it can nevertheless be used in construction of stills. Pikos (*Z. Angew. Chem.*, 1914, vol. 27, p. 152) found that conductors of the second class, such as acetone and methanol, had no action on pure aluminum even at high temperatures, but that they attacked it if small amounts of copper were present. This explains the corrosive action observed by the present writer in the case of aluminum alloys which contained copper or manganese. "Pure" aluminum containing only very small percentages of other metals was little affected.

The ferrous metals were attacked most where exposed to the hot vapors of acetone or methanol. However, this result may be attributed more to the action of a small amount of water therein than to the acetone or methanol itself. Wrought iron showed the most resistance to corrosion of the several ferrous metals tested.

Canadian Phosphate Deposit Found

An interesting discovery of phosphate rock has been made recently on the shore of Francois Lake, west of Fort Fraser, on the Grand Trunk Pacific branch of the Canadian National Railways.

The colonization department of the Canadian National has taken an interest in the discovery and has had an analysis made at the laboratory of the Department of Mines, at Ottawa.

The result is given in the following table:

	Per Cent		Per Cent
Phosphoric acid	32.41	Alumina	1.89
Lime	42.75	Fluorine	3.21
Magnesia	1.85	Silica	5.60
Ferric oxide	3.41	Loss on ignition	9.24
Manganic oxide	.17		

Uses of Corn Many and Varied

While corn is the most important source of starch in the United States and the bulk of all starch and allied products such as dextrin, glucose and glucose sugars are obtained from corn, together with corn oil, used extensively for culinary purposes and also in the manufacture of soap, paint, and rubber substitute, the rest of the corn plant is not utilized extensively in industry at present, though it has a large potential value. According to William A. Taylor of the Bureau of Plant Industry, U. S. Department of Agriculture, the stalks and cobs provide a source of cellulose that may be utilized in the manufacture of paper stock or in such products as celluloid, collodion, sizing and surfacing preparations, etc. Corn cobs may be used as a source of acetic and lactic acids, and also as a source of adhesives and furfural. The manufacture of the latter products has been developed by the United States Bureau of Chemistry.

Corn stalks can probably be so grown as to be utilizable as a source of cane sugar, should conditions necessitate it. Experiments by the Bureau of Plant Industry have shown that by removing the immature ears the sucrose content in sweet corn stalks may be increased to 10.44 per cent in comparison with 12.15 per cent in Louisiana sugar.

Table III—Results of Tests

	Acetone		Methanol	
	Gain or Loss in Milligrams Per Square Decimeter			
Samples	Exposed 1 Month at Temperature of Vapors	Exposed 6 Months in Solvent at Room Temperature	Exposed 1 Month at Temperature of Vapors	Exposed 6 Months in Solvent at Room Temperature
Non-Ferrous Metals				
Aluminum, 28O (pure soft sheet)	− 0.2	−4.2	0	+ 1.7
Aluminum-manganese allow, 38O (soft sheet)	+ 0.8	−4.1	−11.3	−346.0
Aluminum, 178O (alloy soft sheet)	− 3.8	−8.0	+ 4.3	−349.0
Cr and a rich gold	+ 7.2	−2.6	+ 5.9	− 14.5
Cr and a copper	− 7.2	−2.0	− 2.3	− 15.5
Cr and a low brass	+ 5.3	+7.0	− 1.0	− 11.0
Cr and a aluminum bronze	+10.8	+4.8	−13.6	− 0.9
Admiralty bronze	+ 8.8	+9.5	+ 4.8	− 10.8
Phosphorus bronze, 4 per cent	0	+0.2	+ 4.0	− 4.1
Phosphorus bronze, 8 per cent	+ 7.4	+2.3	+ 5.7	− 3.5
Hy-Ten-Sl bronze	−32.9	+0.7	+ 3.7	− 7.9
Manganese bronze	0	+2.1	+ 5.2	− 5.9
Tuc-Tur metal	0	−0.3	+ 5.2	− 24.4
Monel metal	0	+2.3	+ 2.4	+ 1.2
Nickel	0	+1.1	+ 2.5	0
Nickel alloy, 20 per cent	0	+6.8	+ 0.6	− 0.9
Zinc No. 13	0	0	+ 4.0	− 21.3
Zinc No. 53	0	−6.9	− 0.3	− 18.5
Ferrous Metals				
Open-hearth steel	−12.5	0	−66.6	0
Bessemer steel	−86.0	0	+10.5	0
Wrought iron	− 5.4	0	+ 3.3	0
Cast iron	+ 6.2	− .75	−96.1	− 2.5

Plus (+) indicates gain and minus (−) indicates loss in weight of samples tested.

What Machinery Is Necessary for

The Management of Industrial Research

The Second Article Indicates the Kind of Research Organization Necessary in a Special Industry and the Relations With Other Departments of the Company

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IN the past much has been written about the organization of research and development departments. As a rule, this has involved a description of the way in which a particular organization has met its own problems and, although suggestive, is not of general application. The requirements of research and development departments are so varied as to defy reduction to a formula. In a small organization one man has many functions; in a large organization the needs are such that greater specialization is required. Therefore no set plan or chart is here laid out on which an organization may be based. The authors' own experience in The Barrett Co. has been that it was not possible to operate for any great length of time with a rigid, inflexible arrangement, but that it was necessary continually to shift the line-up in order to take care of changing conditions of work.

> The three articles under this title (of which this is the second) consist of excerpts by the Editors from three chapters of a book that is soon to be published entitled "Development Organization." Messrs. Weiss and Downs have handled the subject in a distinguished manner and have rendered a great service to the technical man. They have discussed with frankness and understanding the many perplexing phases of the technical man's relationship to the organization. It is a book that will have a strong appeal to every executive.

Here follows an outline of the method of meeting the general problem of research and development organization in the coal-tar industry. It is believed that the plan found effective there, although specific, will give to others ideas applicable to their own individual organization problems in the same way that the published experience of others was of considerable assistance in that particular instance.

A study of the problems of the laboratory led to the creation of the following main divisions:

1. Tar and oil division.
2. Organic division.
3. Experimental plant division.
4. Special products division.
5. Engineering division.
6. Clerical and stock division.

A divisional head was selected to supervise the work of each division, and under him the work was subdivided into groups with group heads. The chief and assistant chief chemists and divisional heads were in fixed positions, the remainder of the force being flexible in organization so that shifting demands were handled with the least possible confusion. Such a system approximated the military line-and-staff grouping in its make-up. Many problems often required the concerted effort of two, three or even four divisions, each division assuming charge of those phases of the problem upon which it was especially qualified. Each problem as a whole was co-ordinated by the weekly conference of the operating committee or at special conferences, if found necessary. The assignment of specific portions of a problem to different divisions was the province of the chief chemist.

The tar and oil division was concerned largely with the physical testing of the primary coal-tar compounds and products made therefrom, in the main, by mechanical means. Such products are fabricated directly from the crude tars, and include road binders, roofing and building materials and accessories; protective coatings, such as paints and mastics; bitumens and oils used in rubber manufacture; creosote oils; flotation oils for mineral separation; canvas saturants; core compound and fuel pitches; pitch coke; carbolic acid, coal-tar disinfectants and dips; the various grades of coal-tar solvents; pyridine; naphthalene; anthracene, carbazol and other raw materials used for the production of dye and drug intermediates. The processes used for the production of these materials were constantly studied for possible improvement or were discarded in favor of more desirable processes.

The organic division investigated the refined coal-tar products and their chemical derivatives. This division naturally overlapped the tar and oil division in its activities where the line of demarcation was not sharp, but in general there was little difficulty in determining its domain. It was concerned with the investigation of products and processes wherein chemical syntheses or analyses were of more importance than were the physical properties. For instance, included in this category were dye and drug intermediates, and in a few instances, where the origin of the crudes and intermediates gave varying results, the dyes themselves; the recognition, estimation and methods for the commercial isolation of coal-tar constituents the uses of which had not been fully developed; new chemical products that could be produced in large tonnage from the several plentiful coal-tar compounds, such as benzol, toluol and naphthalene, which would yield a high return and diversify the market for them.

The experimental plant division assumed responsi-

bility when new products were practically ready to leave the laboratory stage and proceed into the semi-works scale. It may not be amiss at this point to touch briefly on some of the general factors worthy of consideration in connection with the work of such a division.

Since the expansion from laboratory scale experiments to the experimental plant entails considerable equipment cost, this step should not be taken until all possible exigencies have been investigated in the laboratory. Such items are: The effect of corrosion on materials of construction—for this purpose the laboratory experiments should be conducted as early as possible in vessels constructed of materials which can be used for larger apparatus; the necessity of heat removal or input —where these are important the proper relation of cooling or heating surfaces must be known so as to fulfill the requirements found necessary in the laboratory; the proper mixing of the reacting substances; the proper means for measuring the temperature of large volumes of material; the handling of products from vessel to vessel and all similar conditions, where increase in size of apparatus or batch plays an important part. The experimental plant divisional head should establish close contact and familiarity with the progress of the laboratory work, so as to be conversant with the problem. The interested laboratory division, when it considers that the problem has progressed to a point where it is ready for larger production, must sell the idea to the experimental plant division. The latter, if it buys, must share in the responsibility for the success of the project, or, if it does not believe that sufficient progress has been made, it must be ready to state wherein the data are insufficient and what other information is needed. We believe that the best way to prevent premature starts in semi-works installations is to require the laboratory division, engaged in the original development, to write out a complete description of the process. This description is submitted to the experimental plant division, which, without any oral help or personal assistance, carries out the process in the laboratory as described, keeping in mind the adaptability of the process steps to enlarged operations. If the latter division finds that the description is complete and that the process can be operated without change, it accepts it. If not, it recommends the necessary alterations. After the missing information is collected and the description of the process is considered adequate, the process report is prepared.

Handling the Experimental Plant

The cost of experimental plant work is heavy, not only because of apparatus and erection expenses but also because it is less flexible than the laboratory when changes are necessary; it consumes far larger supplies of raw materials, and large amounts of power, heat, light and labor are required. In this shift from the laboratory to semi-works there is always a gamble. Seldom does a new process graduate from the laboratory stage to the experimental plant and operate from the start without fault. This is caused by the pressing demand for large production and the assumption that all vital information has been obtained in the laboratory. Because of this same demand it is generally necessary to proceed from one stage to the next before every conceivable difficulty or possible improvement has been worked out. Yet on the other hand, if final perfection is waited for, a plant would never be built.

The special products division was engaged in the actual profitable production of chemical specialties of small tonnage. The experience showed that specialties requiring for their production a greater refinement of technical control than do the standard products of the company can best be manufactured by the development department.

The engineering division assisted all of the other divisions by designing and constructing apparatus for their needs, and likewise was responsible for the general upkeep of the plant, fire and safety matters and the like. It was not restricted entirely to the status of a service division, but was encouraged to initiate any mechanical improvements that appeared to be of value.

The clerical and stock division handled the numerous details of records, reports, inventories, receipts and shipments. To serve a progressive technical department properly, this division should be headed by a man of parts. Much of his work is, of necessity, of a routine nature, but the department requires such a diversity of uncommon supplies that a broad knowledge of industry is a great advantage. For the same reason the development department should be restricted to buying only its routine supplies through the general purchasing department of the company. There is no greater obstacle to rapid progress than the hide-bound red tape that requires all inquiries and purchases from outside producers to pass through a non-technical general purchasing department. The research department must very often establish direct contact with the research department of the producing company and not deal, as is frequently the case, through the circumlocutions of non-technical departments. In order not to upset the purchasing routine of the company, orders actually placed should be confirmed through the purchasing department so that proper records are established.

Research Operating Committee

The research operating committee was composed of the chief chemist, the assistant chief chemist, the divisional heads and other members of the laboratory staff. Frequent visits by the manager of the research department, the patent attorney and members of the other departments of the company were made to the weekly meetings of the committee. The chief chemist acted as chairman, and a secretary was appointed to record the reports of the divisional heads and the discussions that took place. The minutes of the previous meeting were read, and during the following week the current minutes were typed, read by the members, who corrected them, if necessary, and attested to their correctness. The minutes of this committee served as a diary of the progress of the problems under investigation and were found to be very valuable in this respect. Unfinished problems that had to be laid aside were noted and carried along as a reminder. The practice of reading at the meetings the minutes of a meeting of the year before gave everyone a picture of the advances made and moreover were very illuminating and assisted in solving some problems that had previously been considered unpromising.

General discussion of the problems of all divisions by every member was encouraged, and this concentrated the interest of everyone on the solution of all problems. Visitors from other departments presented their problems, and patentable ideas were always sought. Small differences of opinion between Mr. Frank and

Mr. Henry as to whose problems were more important and hence required the most urgent assistance of the machine shop were ironed out. Co-operation and a friendly spirit of mutual help resulted, which, if no more tangible result were attained, was worth the time and effort expended.

Such procedure is to be heartily recommended as constituting one of the greatest items for the success of a large research and development department. Without such aid, the maximum size of a development department is limited by the all too small capacity of any executive. With its aid there is no limit within which the activities and service of a live development department must be confined. The chief chemist must make the decisions, but they are more surely correct if founded on the deliberations of such a committee.

This also avoids one fault noted in some development organizations, where the custom is to assign a problem to a man or group and allow it to work out its own salvation with little direction from above. Many times the experiments go far afield and are not properly concentrated on the objective. It is not implied that in true research such close supervision is needed as in development problems, for in the former case the men should be selected for their independence and imagination. Pioneer research does not always lend itself to planning ahead. An operating committee of the type suggested gives to the research chemist advice and direction when necessary and keeps the pioneer work in the right paths without the feeling of resentment which too strict control of detail arouses in individuals of the pioneer type.

Sales Service

Sales service has been popularly termed "trouble shooting," and is needed when the customers have difficulty with the products. A tactful laboratory man can often settle a dispute in one visit which otherwise would result in extended and sometimes acrimonious correspondence. This work is best handled by the laboratory worker who is closely in touch with the control methods involved, provided he has the proper personality to make tactful and pleasant contact with outsiders. In such work the technical man gets a "slant" on the customer's needs that would escape the average sales representative. Such contact results in ideas for new products as well as for improvement of the old product and is an important source of constructive criticism and suggestion. If individuals in the sales department have come from or circulated through the technical departments, they may be intrusted with such work.

One of the questions that often arises in disputes with customers is quality of the product supplied. The customer has a specification, and although in many cases the trouble is faulty manufacture, in many more the difficulty can be traced to differences in the method of test. Such occurrences are more likely when dealing with commercial mixtures, such as bitumens, gums, waxes, etc., where the prescribed characteristics are on the basis of tests, usually physical in nature. Such tests are proximate and give a result that may vary considerably unless the test is carried on under rigidly controlled conditions. Tests for the determination of the consistency of bituminous materials (the so-called melting point, viscosity tests, float tests, etc.) are almost entirely of this kind. Many times, in cases of this nature, the writers have regretted the apparent inadequacy of the written word to transmit thought properly. They have often gone through a tedious and voluminous correspondence between two laboratories that could not, with the best intentions, obtain concordant results on a duplicate sample of material, although they were working from the same set of printed directions in carrying on the test. After the two workers were placed side by side in the same laboratory, each with his own apparatus, the cause of the discordance was soon found and would almost always give a new precaution necessary in carrying on the test in question. The fact would develop that the test directions were not explicit on some particular point that hitherto was not regarded as of importance. As a result, the test methods gradually become nearly foolproof.

> Food for thought.
>
> "Sales service has been properly termed 'trouble shooting,' and is needed when the customers have difficulty with the products. A tactful laboratory man can often settle a dispute in one visit which otherwise would result in extended and sometimes acrimonious correspondence."
>
> Does your company believe in the technical man as liaison officer? Or does it cling to the obsolete dogma, "Technical men can't sell anything, even themselves!" And finally, if the latter is true, how much of it is your fault?"

The domain of sales service merges into the province of the sales department and its corollary—the proper education of salesmen to serve the technical industries. It is needed not only in connection with the established products of the company, but more particularly in the case of new products in process of development. As stated above, diversification of products was the intent of The Barrett Co. This was attempted wherever it was believed possible to develop large sales. We firmly believe that this policy was correct, as demonstrated by the remarkably uniform business record made by The Barrett Co. during both financial booms and depressions for years back. It is not intended that the impression be given that proper diversification means a multiplicity of products differing from one another only in minor details or a multiplicity of specialties consumed by only a few industries. Such a policy results in misspent effort or in too much dependence upon the success of consumers in a few fields. Each company has a certain field in which it should maintain consistent effort. It will, however, make discoveries outside of this field that have commercial value. In such cases some large companies organize a subsidiary company, which has as its sole aim the special development. In this way the company expands its sales without expanding and diversifying the parent organization too far. This course is, in our opinion, wise procedure.

The sales department must, of course, keep pace with the increase in the number of products and familiarize itself with the new industries to be served. Such expansion of horizon of the sales department can best be attained by constant and close co-operation with the development trend. The placing of new products on

the market calls for sales research and complete understanding of the problems in hand, both production and consumption. Such sales research must start early in the development, so that there will be no lost time between the technical success of the process and its commercial success. To accomplish this the public must be educated, and such education is best carried on while the process is still in the experimental plant stage, so that the large-scale plant may be constructed with the assurance that its output will be sold.

If, as noted before, means are provided for the transfer of properly qualified men from the development department to the sales department and for occasional recirculation of selected men back through the former, such acquaintance with the technical progress may be assured. Likewise, the development department can serve the manufacturing department by assisting in training the production men better to fulfill their responsibilities.

Such activities fit in, to the great advantage of the company, particularly during business depressions, when there is likely to be an oversupply of valuable sales and production men. It is an economic loss to lay off such men or to maintain them in non-productive positions during such periods, but this loss can actually be translated into an economic gain by assigning to development work such men as can be spared. They all have ideas concerning the shortcomings of the regular products of the company or of its competitors, and the possibility of improvement in manufacturing processes, as well as notions of new products to fill the public demand. Such ideas cannot be worked out when sales and production pressure are at high levels and every man is needed at his post. When these are at low ebb, these men should be transferred to development and their activities be bent toward insuring the superiority of the company at the next pick-up of business. This policy, to the authors' knowledge, has been practiced by one company with great success.

Patent Department

Some systematized method of taking care of patentable discoveries should be a part of every organization. This function belongs in the research and development department, since the great bulk of new processes and improvements in existing processes originate there, or are at least investigated there. This responsibility should not be a function of the general legal department. The man responsible for patents, although closely in touch with the legal department, should be an employee of the development department. He may or may not be accepted as an attorney by the Patent Office (although this is desirable), but he must have such a background that he can recognize invention when the chemist himself may not realize it and must be familiar with the business and its needs. He should work with the advice and guidance of a recognized general practicing patent attorney. The outside attorney, with the background of interference and other litigative proceedings, can do much to strengthen the claims and specification before filing, with the future in mind. If the case comes to litigation or interference, the outside man who will handle the case is already sufficiently familiar with it to have a real background.

One phase of the research and development department organization that can be discussed rather specifically is its relation to the general organization, particularly from the standpoint of the proper guidance of the work into the channels that are, or appear to be, of most real benefit to the corporation in question. This can best be accomplished by means of a committee. In general, we do not approve of management by committee, for no committee should be intrusted with executive functions. In an advisory capacity, however, a proper type of committee can do much to aid the research and development department in charting its course.

A research and development committee, composed of the higher executives of the company and the managers of the sales, purchasing, manufacturing, legal and research departments, should be formed to consider the broad questions relating to future aspirations and thereby establish a goal for the research and development department. At the meetings of such a committee the interested members may express their views as to the importance of work in their respective fields, whether suggested by their departments or by the development department. The director of research then develops the budget necessary to accomplish these ends, and approval or rejection of the same depends upon the activity of the departmental heads in showing that their field should not be slighted. It is then up to the manager of the research and development department to produce the greatest good out of the revised and accepted budget.

There will arise exigencies in the work that are not predictable, when special appropriations must be made. For instance, during the year the laboratory work on some problem may have progressed with sufficient rapidity to make an experimental plant unit advisable. A special appropriation is then in order and a meeting of the research and development committee is called, If the director of development can show to the satisfaction of the committee that the problem is in such an advanced stage, the committee approves a special appropriation, which is passed upon by whatever body has the power to grant appropriations. The research and development committee should not attempt to prescribe the detailed procedure that should be followed to accomplish the result, as such discussions usually lead to no useful end. Their recommendations should always be acceptable, but their deliberations should be confined to mapping out the broad policies. The research operating committee should be responsible for the actual experimental procedure.

Potash Production Gains at Searles Lake Plant

The status of the American potash industry is indicated to some extent by the following figures from the American Trona Corporation's plant at Searles Lake, Calif., for the year 1923.

The total production for the year amounted to about 30,000 tons of potash salts averaging 96½ per cent KCl on the dry basis and about 14,000 tons of pure borax.

This year the plant is doing still better. The report for the week ended Feb. 13 showed a production of 732 tons actual KCl and 312 tons actual borax, besides other products. This shows that a ton of actual KCl or borax is being delivered from the plant every 10 minutes day and night.

Controlling Sand Drown in Tobacco by Magnesia

To prevent sand drown, or magnesia starvation, in tobacco the North Carolina Agricultural College is advising the use of magnesia in the form of either a carbonate or a sulphate.

Design and Operation of Ball and Pebble Mills

Practical Notes on Factors Affecting the Operation of Non-Continuous Ball or Pebble Mills

By Edward W. Lawler
President, Aacone Engineering Corporation, North Plainfield, N. J.

ALTHOUGH ball, pebble and rod mills have been in use for many years, there is still room for improvement both in design and in operating technique. Even in the metallurgical field, where the enormous tonnages to be pulverized have made imperative thorough studies of the best operating conditions, there are many points that are still unsettled.

There is hardly an industry using pulverizing equipment that cannot profit by a better understanding of the factors affecting the efficiency. Realization of this has prompted the writer to outline a few suggestions of practical value. The main factors to be considered in the case of non-continuous ball or pebble mills are as follows:

Factors of mill design: Shape, proportions, lining and discharge openings.

Operating factors: Size of feed; feed load; kind, shape, size and load of balls or grinding media; wet or dry grinding; speed of mill; time of grind.

Before going into detail on any of these points, it should be emphasized that ball, pebble and rod mills are easy to operate—if one knows how. The exact degree of skill required varies according to whether the mill is of the continuous or of the batch type. To obtain best results from a continuous mill requires most careful, constant watching and sampling of product at frequent intervals; otherwise it "falls off" and the oversize builds up in the circuit. While a 350- to 400-mesh product can be obtained using classifiers, microscopic examination of certain materials, such as paint stock, will show that the extremely fine material that gives "texture" is not present in as large a proportion as when batch mills are used.

With the batch mill, it is possible so to standardize all factors in advance that every charge receives exactly the same treatment. Once the factors have been determined for a given material, an unskilled laborer can successfully operate a batch mill and reproduce the same results each time. For certain materials, it will be found that the batch mill gives a finer and more uniform product for less money and with less worry. The discussion that follows applies particularly to the non-continuous mills.

> ***DISINTEGRATION***
>
> **Data on operation of grinding equipment have developed largely in the metallurgical industries, where the huge tonnages handled have made definite information imperative. Unfortunately it is not always possible to use these data directly in the chemical engineering industries, where quantities are smaller and properties more varied. Those in charge of grinding operations cannot fail to profit from a more careful study of the factors outlined in this article.**
>
> ***A UNIT PROCESS OF CHEMICAL ENGINEERING***

Mill Design

Within recent years it has become recognized that only part of the balls in a mill are doing useful work and there have been a number of attempts to remedy this situation. Certain modifications in mill design are involved in these developments, although details are not available, pending the completion of operating tests.

For mills grinding many chemical products, porcelain or flint linings have become almost traditional, but in many cases it will be found that metal linings and grinding bodies give better results. After wearing awhile, a cast-iron or steel plate lining will have all the pores hammered shut and thus present a smooth impervious surface, easily and quickly cleaned. This is particularly important where the mill is used for a variety of materials.

Many batch mills are provided with only one manhole for discharging, even though the mill may be as much as 10 ft. long. For wet work this is all right, but on dry work the material cannot possibly discharge without excessive pebble and lining wear. At least 50 per cent of the material will be discharged on the first revolution of the mill and then the mill will continue to revolve practically empty except for the pebbles. The material that breaks off from the pebbles and lining during this period may seriously contaminate the product of hours of grinding. One manufacturer recently noted a loss of from 12 to 56 lb. of pebbles in a small mill by checking his pebbles for different weeks—a variation of several hundred per cent in pebble consumption.

Some years ago a large drug manufacturing company tabooed pebble mills. Investigation showed that the mill was tested by loading it half full of pebbles and running for some time. After the test was over, 10 per cent of the pebbles had been ground off, but there was nothing in the mill but pebbles. Later some one must have discovered in this a sign of efficiency and today that company uses a number of pebble mills, as they are the only mills that will grind properly with a minimum shrinkage and at the same time, within limits, deliver a finished product without separating devices.

To overcome the difficulty in discharging, one type of mill has been built with sloping sides that direct the material toward the manhole. Proper attention should also be paid to the matter of designing manhole covers. Unless there is a good, tight joint between the cover and the lining, unground material will lodge in the space and then drop with the finished product when the cover is taken off.

Grinding Media

When using balls or pebbles, the main thing to bear in mind is that the number of grinding contacts presented by a given number of balls remains constant regardless of the size of the balls. With some materials, it is advantageous to reduce the size of the balls, thus presenting more grinding points per unit of volume. The shape of the grinding body has a decided influence on the character of the product. Metallurgical studies have shown that round balls tend to produce a granular product and are thus more suitable for concentration work than flint pebbles, which are irregular in shape and produce more slimes. As fine

grinding is the result of friction between the particle and the grinding body, the more friction the more fine grinding will take place. This probably explains why a mill loaded with flat slugs, such as punchings from a boiler shop, will do more fine grinding than when small round balls are used. It is within the range of possibility that button-shaped bodies may be found most efficient for fine grinding.

When grinding wet with metal balls, it may be advisable to use a thicker slurry than with porcelain balls. For best results there should be only enough liquid to lubricate the grinding bodies so that they will move freely in the slurry. The lubrication required is proportional to the unit weight and area of the grinding body. In a given slurry, an iron ball will sink faster than would a ball containing the same weight of a material of lower specific gravity. Accordingly if a mill were running satisfactorily with procelain balls and a change to steel balls were made, it would very likely be necessary to use a thicker slurry in order to get the same results. As the load ascends in the mill it breaks as the crest of a wave and rolls to the bottom of the mill. When it reaches the crest, it must be of a consistency that will permit it to break away and roll before centrifugal force carries it over and drops it from the top of the mill or slams it against the opposite side.

It is also possible to achieve the same result by varying the speed instead of the consistency. In a mill using light, large area grinding bodies the peripheral speed must necessarily be less than when heavier bodies are used.

The speed of the mill should be such that the pebbles when lifted to the proper height will roll down on the top of the ascending pebbles and take the longest possible path to the bottom. If the material is so coarse that the pebbles must be carried past the point where they will roll down the incline and do the grinding by attrition, to the point where they must be dropped and do the grinding by impact in order to break down coarse pieces, then the feed is too large for the mill. In this way the size of the feed has an effect on the speed of the mill, but the better way is to remember that a pebble mill is a fine pulverizer and not a crusher, and that fine pulverizing can best be done by attrition instead of by impact.

Time of Grind

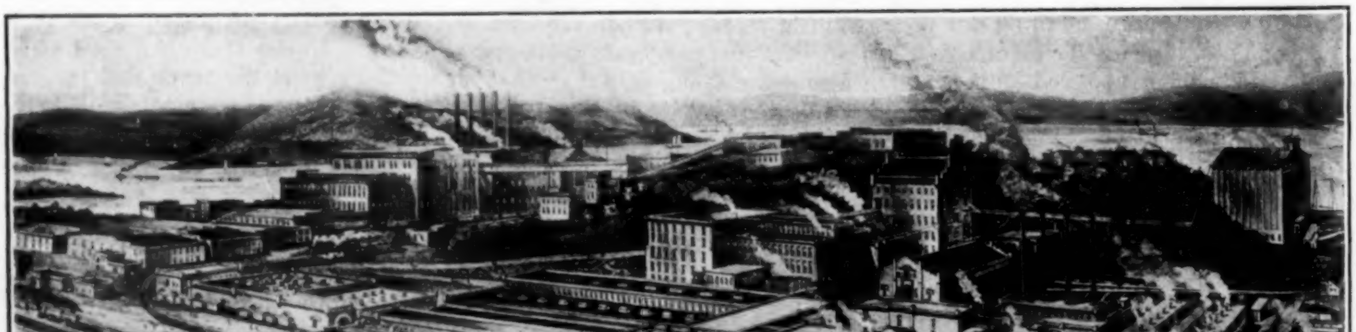
It is a mistake to operate a mill for a certain period of time, for it occasionally happens that a mill will stop for 10 or 15 minutes or even longer and yet the charge may be taken out at the end of the time set regardless of whether or not it is finished. A much better plan is to attach a revolution counter to the mill and run the mill for a given number of revolutions rather than for a certain length of time.

Care in Selection of Mills

In buying a mill for industrial work, it is well to take nothing for granted, but to make the seller of the mill understand thoroughly the purpose for which the product is intended and if screens were used less and the microscope more, the chances are that the buyer of the mill would get a mill to do his work the way he wants it done.

Mills should not only be selected for the work they are to do but should also be operated properly and the results carefully checked and records kept so that the results acquired can be continuously duplicated at a minimum cost.

Recently a prominent engineer connected with a large concern informed the writer that they "could buy thousands of dollars worth of machinery without any trouble, but when they wanted to spend a few hundred or a thousand dollars on a grinding mill, by the time they had finished talking to all the salesmen, they were more at sea than when they started and the only thing to do was to buy one they thought best and work it out if possible." This would indicate that the mill manufacturers do not go deeply enough into the question of cause and effect as applied to the industrial grinding field.



Great Chemical Engineering Industries—Fleischmann Co. Plant at Peekskill, N. Y.

Equipment News

From Maker and User

Portable Factory Elevator

Many factories do not have, and are not adapted by design for the installation of, freight elevators. In other plants it is desired to serve platforms or mezzanines that are not so located as to be convenient for service from existing elevators. To meet this need a new portable elevator, illustrated herewith, has recently been placed on the market by the New Jersey Foundry & Machine Co., 90 West St., New York.

This machine is built in capacities from 1,000 to 6,000 lb. Platform sizes range from 3½x5 to 6x10 ft. It is a unit, used either portable or fixed, and requires no support from the building other than its floor bearing. It is provided with electric control for automatically stopping the platform at the high and low points, electric brake that stops the platform at any set level and safety stop control. Operator can control from high or low level or from platform.

Portable Factory Elevator

Induction Motors

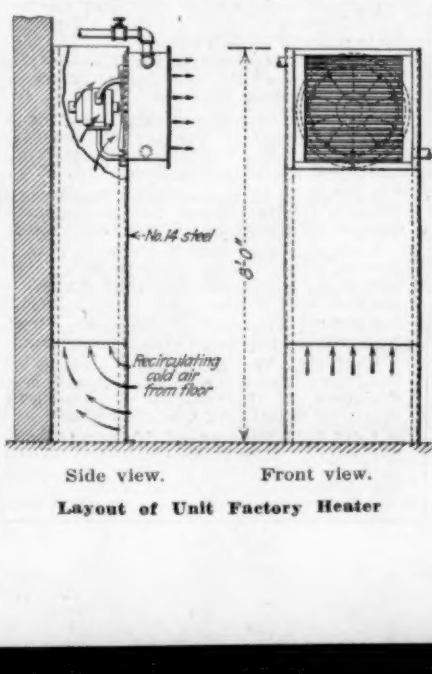
Two new types of induction motor are now being marketed by the General Electric Co. The SCR single-phase motors are designed for constant speed at sixty, fifty or forty cycles, in sizes from ½ to 10 hp., and are interchangeable for 110 or 220 volt circuits. The KT-900 type is a riveted frame, polyphase induction motor, of three- and two-phase, squirrel-cage, sixty-cycle design, and is being sold in sizes ranging from ½ to 15 hp.

The new single-phase motor, operating on the squirrel-cage induction principle, entirely eliminates the short circuiting switches heretofore considered essential and permits very simple construction. It combines high starting torque with low current demand and has operating characteristics similar to those of the induction motor. Both the maximum and accelerating torques are approximately 200 per cent of full-load torque without any low points during acceleration. The no-load and full-load speeds are respectively about 3 per cent above and below synchronous speed, giving very close regulation for a motor of this type.

The stator winding consists of simple concentric polar windings arranged for double voltage connections. The rotor contains a cast squirrel-cage winding and a repulsion wire winding of the multiple type with equalized commutator connections to insure uniform distribution of armature currents.

The polyphase motor is a 40 deg. continuous duty riveted frame machine. The electrical improvements embodied in this new line comprise reduced heating, higher efficiency and higher power factor at full and fractional loads, and increased starting torque, the maximum torque ranging from 275 to 300 per cent of full load synchronous torque for different sizes. The accelerating torque curves are free from dips common to those of preceding types.

The principal mechanical improvements include from 50 to 100 per cent increase in oil reservoir capacity, a new method of directing the ventilating air to prevent dirt from settling on the windings, and a "cast" rotor of one-piece construction having no joints or high resistance spots.



Layout of Unit Factory Heater

Factory Heating Unit

The American Blower Co., Detroit, Mich., has recently placed on the market a unit factory heater that will prove of interest to the large number of industrial plants that find it necessary to supply artificial heat in order that their workers may be comfortable in the winter time.

This unit is called the "Venturafin" heater. Its distinguishing characteristic is that the steam heating coil consists of brass tubing having a spiral fin wound around it the entire length. This fin greatly increases the heat-transmitting surface of the tube, making it nearly five times that of the tube alone.

As shown in the accompanying sketch, the coil is set near the top of a 14-gage steel housing. Cool air is drawn in from below and forced through the heating coil out into the room, by means of a standard "Ventura" motor driven fan. This equipment, minus the housing, can also be obtained to attach to the roof truss in places where space for floor installation is not available.

Manufacturers' Latest Publications

The William J. Sweet Foundry Co., Philadelphia, Pa.—A folder describing castings in Monel metal and pure nickel made by this company, and indicating the industrial applications of such equipment.

The De Laval Steam Turbine Co., Trenton, N. J.—A new bulletin describing the use of centrifugal pumps for water supply.

The Quigley Furnace Specialties Co., 26 Cortlandt St., New York City—A booklet describing "Ganisand," which is a highly refractory ganister for lining and repairing industrial furnaces and making refractory tile and special shapes. This booklet contains full directions for use in various types of furnaces.

The J. W. Paxson Co., Philadelphia, Pa. —Bulletin 43. A catalog of Paxson sand blast and dust-collecting equipment. A complete description is given of the cloth screen type of dust collector and also of the industrial uses of this equipment when associated with sand-blasting equipment.

The Palo Company, 153 W. 23rd St., New York City—A folder on various instruments made by this concern for use in the industrial plant and laboratory.

Quigley Furnace Specialties Co., Inc., 26 Cortlandt St., New York—Bulletin A-113. A booklet describing Quigley acid-proof cement, a ready-to-use cement for bonding and surfacing masonry that is exposed to acid corrosion.

Crouse-Hinds Co., Syracuse, N. Y.—Folder 8. A folder on the FS series of condulets for switch and plug receptacle outlets.

The Steere Engineering Co., Detroit, Mich.—Pamphlet 258. A leaflet on the use of the "backrun gas" process at the Beargrass plant of the Louisville Gas & Electric Co., Louisville, Ky.

Review of Recent Patents

Enriched Air Blast for Metallurgical Furnaces

Modified Liquefaction Process for Oxygen Produces Enriched Blast Without Rectifying Apparatus and Provides Refrigerative Drying of Blast

CLAUDE C. VAN NUYS, of Cranford, N. J., has modified the liquefaction process for making oxygen so that it may be used for supplying an enriched air blast to metallurgical furnaces. (Patent 1,485,745, March 4, 1924, assigned to Air Reduction Co.)

The production of an oxygenated blast by liquefaction of air, rectification of the liquid and commingling of the oxygen produced with further quantities of air to supply the mixture of the desired oxygen content to a metallurgical furnace has been heretofore suggested. The benefits to be derived from such procedure have been mathematically calculated and practically demonstrated. Unfortunately, however, there are numerous obstacles in the way of actual adoption of the method outlined. In the first place, the rectification of liquid air is a delicate and costly operation, requiring a large expenditure of energy and expensive apparatus. The cost multiplies to a prohibitive degree when we consider an apparatus capable of supplying a sufficient quantity of oxygen to an iron blast furnace. Second, there is still the necessity of providing the usual drying plant for the blast if the most effective operation is desired, and the advantage of the oxygen-enriched blast does not offset the expense of operating the liquefaction and drying plants. Thus the entire proposal becomes impractical and offers no effective advance in metallurgical practice.

In Mr. Van Nuys' process, the entire air supply for the blast is refrigerated by the excess cold of a liquefaction system and is thereby dried. A portion of the air is then treated to separate and discard a fraction of the nitrogen, thus producing an enriched oxygen mixture, which is subsequently added to the remaining dry air. The process depends upon the production of a gaseous mixture of limited oxygen enrichment, which is then added to air to produce a mixture of more limited enrichment.

To this end the greatest advantage is taken of the possible enrichment when atmospheric air is liquefied in a condenser employing the principle of "backward return" or passage of the condensed liquid counter-current to and in direct contact with the incoming air. Hence the highest oxygen content obtainable in the enriched product will be approximately 45 to 47 per cent, since this is the composition of a liquid that will have phase equilibrium with a gaseous mixture having the composition of atmospheric air. The method thus makes available the maximum quantity of gaseous nitrogen delivered at the top of the "backward return" condenser at the original pressure at which the air is delivered to the condenser.

A part of the nitrogen thus rejected is employed to produce the required refrigeration in the liquefaction cycle by expanding it in a suitable engine or turbine after its temperature has been raised to the proper point by indirect contact with the ingoing air. The energy thus recovered is available for compressing further quantities of air or for other purposes. The remainder of the high-pressure nitrogen, after its temperature has been raised to that of the surrounding atmosphere, may be advantageously utilized with or without the addition of external heat in an expansion engine or turbine to assist in driving the air compressor, or as an alternative it may, without the addition of external heat, be employed to assist, after its expansion in an engine or turbine, in refrigerating the unseparated air to which the enriched product is added in producing the blast. The energy derived from any of the expansion engines or turbines may be utilized in compressing further quantities of air.

Since the method employed insures a product enriched in oxygen to approximately 45 per cent, it follows that the amount of nitrogen rejected is by volume more than one-half the volume of air entering the liquefaction cycle. Hence the energy available upon expansion of the nitrogen in an engine or turbine is considerable and only enough additional energy to compress the air going directly to the blast and to make up losses need be supplied. In any blast furnace the air must be compressed, and inasmuch as the air and enriched product, when the method is applied to this use, pass directly to the blast furnace at substantially the original pressure, there is no considerable loss of energy through the introduction of the liquefaction cycle.

All of the refrigeration necessary to cool and dry the air required for the blast may be produced by the expansion

American Patents Issued March 18, 1924

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests, and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,486,936—Apparatus for Automatically Separating Liquids of Different Specific Gravities. Joseph E. Swendeman, Philadelphia, Pa.

1,486,961—Manufacture of Chrome Alum. Peter Hasenclever, Hamburg-Billvader, Germany.

1,487,004 — Strainer for Pulp Digesters. Carlton H. Allen, Glens Falls, N. Y., assigner of one-half to Great Northern Paper Co., Millinocket, Me.

1,487,020 — Oxidation Process. Alwin Mittasch, Ernst Willfroth, and Otto Balz, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin & Soda Fabrik, Ludwigshafen-on-the-Rhine, Bavaria, Germany.

1,487,035—Apparatus for Use in the Manufacture of Rubber Goods. Thomas Sloper, Devizes, England.

1,487,036—Apparatus for Use in the Manufacture of Rubber Goods. Thomas Sloper, Devizes, England.

1,487,043—Welding Method and Apparatus. Floyd S. Youtsey, Collinsville, Ill., Edward C. Walker, St. Louis, Mo., and Ashleigh S. Moses, New York, N. Y.

1,487,046 — Process of Recovering Various Salts From Saline Liquors. George B. Burnham, Borosolvay, Calif.

1,487,124—Electrolytic Process. James Robert Stack, Perth Amboy, N. J., assignor to American Smelting & Refining Co., New York.

1,487,125—Process of Recovering Tin. James Robert Stack, Perth Amboy, N. J.

1,487,132—Tin Sinter and Method of Producing Same. Harry H. Alexander, Westfield, N. J., assignor to American Smelting & Refining Co., New York.

1,487.133—Process of Forming Iron-Tin Alloy. Harry H. Alexander, Westfield, N. J., assignor to American Smelting & Refining Co., New York.

1,487,134—Process of Recovering Tin. Harry H. Alexander, Westfield, N. J., assignor to American Smelting & Refining Co, New York.

1,487,135—Recovering Occluded Tin. Harry H. Alexander, Westfield, N. J., assignor to American Smelting & Refining Co., New York.

1,487,136—Electrolytic Refining of Tin. Harry H. Alexander, Westfield, N. J., assignor to American Smelting & Refining Co., New York.

1,487,182—Apparatus for Obtaining Alcohol. Worth H. Rodebush, Berkeley, Calif., assignor to U. S. Industrial Alcohol Co.

1,487,205—Process for the Removal of Fluorine Compounds From Phosphoric Acid. John N. Carothers and Arthur B. Gerber, Anniston, Ala., assignors to Federal Phosphorus Co., Birmingham, Ala.

1,487,240—Process of Treating Acid Sludge. Emerson C. Higgins, Jr., Tulsa, and Orsino C. Smith, Sand Springs, Okla., assignors of one-half to Cosden & Co., Tulsa, Okla.

1,487,248—Heat Interchanger. Grover B. Lantz, Colton, Calif.

1,487,402—Fluid-Flow-Measuring Device. Erich Roucka, Blansko, Czechoslovakia.

1,487,449 — Extraction of Fats and Oils. Clarence Ford Eddy, Waverly, Mass., assignor to Cocoa Products Co. of America Inc.

1,487,456—Process of Distilling Materials. Martin L. Griffin, Rumford, Me.

1,487,521—Fixation of Nitrogen by Means of Titanium and Its Transformation Into Industrial Products. Paul Andreu and Rene Paquet, Paris, France.

1,487,554—Process for Hardening Steel Alloys. Adolf Fry, Essen-Stadtwald, Germany, assignor to Fried. Krupp Aktiengesellschaft, Essen-on-the Ruhr, Germany.

1,487,601 — Wood Grinder. Paul Priem, Heidenheim-on-the-Brenz, Germany, assignor to American Voith Contact Co., Inc., New York.

1,487,647 — Process of Recovering Nitrogen From Residual Ammonia Oxidation Gases. Giacomo Fauser, Novara, Italy.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

of the rejected nitrogen. The large expense incident to the maintenance of a refrigeration plant, such as is now widely used to dry the blast, is thus avoided and the drying is accomplished in a very satisfactory and economical manner.

Summarizing the advantages of the invention as applied to metallurgical furnaces, it eliminates the hot blast stoves, because the higher initial temperature produced by the oxygenated blast makes preheating of the blast unnecessary; it provides for refrigerative drying of the blast without additional refrigerating equipment, since sufficient refrigerative effect is available in the liquefaction system; and it produces an oxygenated blast at relatively slight expense, which is fully compensated by the advantages obtained. A higher temperature in the melting zone of the furnace is produced by the blast and the work of the furnace is accelerated. Incidentally, a considerable volume of nitrogen which otherwise absorbs large quantities of heat in the furnace is eliminated, and the losses from this source are reduced.

Nitrating Apparatus

Nitration of Cellulose Completed in a Cylinder With a Spiral Lining Dividing It Into Compartments

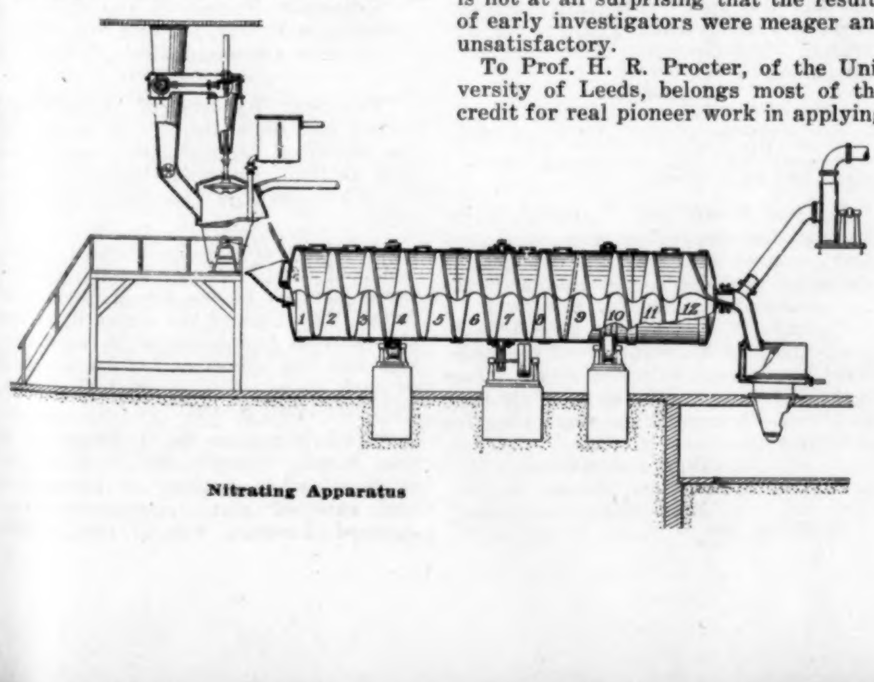
George Juer, of Hopewell, Va., in Patent 1,485,507, issued March 4, 1924, and assigned to the Tubize Artificial Silk Co. of America, indicates a method whereby a single mixing pot is able to do work that formerly required several.

The function of the mixing pot in nitrating cellulose is to obtain intimate contact between the dry cotton and the mixed acid. After the cotton has been thoroughly wetted by the acid it is necessary to allow them to remain in contact until nitration is complete. During this period the mixing pot remains idle so far as its primary function of mixing dry cotton with acid is concerned. Mr. Juer suggests that the completion of the nitration might just as well take place away from the mixing pot, and has accordingly developed an apparatus for accomplishing this desirable result.

Referring to the accompanying illustration, at the left above the platform will be noted the usual arrangements for feeding dry cotton and acid to the mixing pot. After the preliminary mixing the charge is dumped into the cylindrical receiver shown in the center. This consists of a rotatable cylinder having a spirally twisted plate secured to its inner wall. The cylinder is thus divided into twelve separate compartments, but because of the spiral plate rotation of the cylinder causes the contents of the compartments to move toward the discharge end.

After a charge has been dumped from the mixing pot through the hopper into compartment 1 of the cylindrical receiver, the latter is rotated one full turn. The charge just dumped is thus moved to the position indicated by compartment 2, while the contents of compartment 12 are discharged into the wringer shown at the lower right hand side. There is thus an intermittent progression of the charges through the receiver. While the cylinder is in motion the tumbling action imparted to the charge insures thorough mixing with the least possible tearing or disintegration of the cotton fibers. The cylinder is long enough so that each charge is completely nitrated by the time it is discharged into the wringer or centrifuge.

It is obvious that with this arrangement a single mixing pot and mixing apparatus can be kept in practically continuous operation. For the removal of fumes, a hood over the mixing pot and a conduit from the end of the receiver are provided.



Nitrating Apparatus

Book Reviews

Leather Manufacture

CHEMISTRY OF LEATHER MANUFACTURE. By *John Arthur Wilson*, chief chemist, A. F. Gallun & Sons Co. 343 pages, 150 illustrations. Chemical Catalog Co., New York. Price, $5.

Probably everyone who has had occasion to study the production of leather has wondered why it is that this industry has remained for the most part an empirical art while other industries just as ancient have made rapid strides technically through the application of scientific principles. The answer lies, of course, in the fact that the art is frequently in advance of the science. In the case of leather, development of the science has been delayed by the physical and chemical complexity of the principal materials involved. Proteins and tannins—it would be difficult to select two groups that have given chemists more trouble than these. It is of more than passing interest to note that the greatest work in elucidating the chemical nature of these two groups was done by one man, Emil Fischer. With so little knowledge available as to the chemical constitution of protein and tannin and still less as to the physical chemistry of reactions taking place, it is not at all surprising that the results of early investigators were meager and unsatisfactory.

To Prof. H. R. Procter, of the University of Leeds, belongs most of the credit for real pioneer work in applying science to leather manufacture, and it is eminently fitting that the greatest developments within recent years should have been made in the laboratories of one of his pupils and associates. The results of many of these studies, conducted by Mr. Wilson at the Gallun laboratories and by Prof. A. W. Thomas under the Gallun research fund at Columbia University, have been embodied in the book under review and indeed form the basis for a considerable part of the volume.

Many tools have been called to the aid of the investigator in these studies. The microscope has played a most important part in explaining the structure or histology of the skin and the changes that take place in the skin as a result of tannery operations. For studying the physical chemistry of many of the reactions, the hydrogen electrode has been invaluable, and it has also been found most effective for plant control. The whole subject of hydrogen-ion concentration is clearly presented and the application of these principles to the physical chemistry of the proteins forms a chapter of unusual interest.

The fundamental factors underlying each tannery operation have been the subjects of careful investigations, and the results form the most comprehensive picture of the actual mechanism of tanning procedures that has ever been published. Preservation by drying or salting, soaking and fleshing, unhairing and scudding, bating, drenching and pickling, vegetable tanning, chrome tanning—to each of these is devoted a chapter full of meat for the tanner who is able to interpret and apply the data.

Even those not directly connected with the leather industry cannot afford to pass by this book, for it presents in a clear interesting manner the story of how a great industry can be raised from an art to a science.

ALAN G. WIKOFF.

Trade Names

CHEMICAL SYNONYMS AND TRADE NAMES. By *William Gardner*. 271 pages. Crosby Lockwood and Son, London. Price, 25s.

Approximately 14,000 definitions and cross-references are contained in this dictionary and commercial handbook. It serves to interpret commercial names for chemicals, dyes and related materials in terms of the correct scientific designation. This is its primary func-

tion and it is not strictly speaking a chemical dictionary, for the only names listed are those which do not disclose their chemical nature. Because of this arrangement it is not possible to determine whether trade names exist for a correctly named product. The inclusion of such data might have increased the size of the book unduly, but there are often occasions when it is desirable to find out whether a product such as hydrochloric acid is known by any other names in the trade. This comment is not intended as a criticism, but merely as a suggestion that might prove of interest in subsequent editions.

New Publications

THE IMPERIAL INSTITUTE has published a monograph on Vanadium Ores by members of the scientific and technical staff of the Imperial Institute. Copies can be obtained from John Murray, Albemarle St., W., London, England, for 5s. net.

TRADE STANDARDS. Adopted by the Compressed Air Society. It embraces the nomenclature and terminology relating to air compressors and their operations; a history of the development of speeds of air compressors; an explanation of capacities and pressures; instructions for the installation and care of air compressors, with illustrations of devices suggested for cleaning the intake air; recommendation for the lubrication of air-compressing machines and the cleaning of air receiver piping; a description of the low-pressure nozzle test recommended by the society, and a partial list of applications of compressed air. Copies may be had from the members or by addressing the secretary of the society, C. H. Rohrbach, 50 Church St., New York, N. Y.

Readers' Views

Research Chemists at $150 Per

To the Editor of Chem. & Met.:

SIR—The following advertisement appeared in a Cleveland, Ohio, paper recently:

> ORGANIC research chemist, recent clean cut Amer. grad., reading knowledge scien., Ger. req'd. Rubber industry outside Cleveland; salary to start, $150.
> INTERSTATE EXCHANGE.

The salary mentioned is quite the usual stipend offered technical men these days and in order to voice our disapproval of these conditions, one of my associates wrote the following letter of application.

Having noticed several editorial comments in your columns upon this and similar matters, I thought possibly you might care to publish this letter.

CLARENCE C. ROSE.

THE LETTER OF APPLICATION

Cleveland, Ohio.

Interstate Exchange,
Cleveland, O.

GENTLEMEN—In reply to your recent ad for an organic research chemist, may I submit with due humility my qualifications.

I was graduated from one of our leading technical schools several years ago, a B.S. chemist. The knowledge gained there consisted mainly in learning my own limitations.

I next spent several years in pure organic industrial research, during which time I learned to speak German fluently—with my landlady. This I believe should make me particularly well fitted to investigate your rubber research problems in "Die Wächter und Anzeiger" publications.

Furthermore, I am a willing worker —willing to get my hands dirty if unavoidable—willing to work 12 to 14 hours a day and 7 days a week. The only holidays I observe are Yom Kippur and St. Patrick's day.

If these qualifications do not suffice in your estimation as being an equitable return for the munificent salary offered —namely, $150 per month—I am prepared to offer further inducements.

I always stand ready to do odd jobs around the factory, sweeping out, washing windows, etc. I am an excellent automobile mechanic fully qualified to repair your laborers' Peerless and Packard limousines as readily as the Fords of your other chemists—if there are any chemists so fortunate as to own one. I also would be willing to run errands for your stenographers and contribute the use of my own roller skates in the performance of the same.

In closing I merely wish to add, so that you do not form the impression that I am particularly avaricious in pecuniary matters, that the salary you offer, $150 per month, is really more than a man of my ability could expect to receive and keep his conscience clear. So a reduction from the above-mentioned sum, of four or five million marks, will make no difference to me. It is the opportunity I seek.

Yours truly,
CHEMICAL STEINMETZ.

P. S.—Never mind, I've got a good job anyway.

Why Keep a Research Staff?

To the Editor of Chem. & Met.:

SIR—From time to time we have noted that the editorial columns of *Chem. & Met.* have commented upon the closing down of research operations by certain of our large corporations. We mere chemists, who have struggled long and laboriously not only to get our training but also to "sell" the value of research to the public at large, have wondered why such steps as those mentioned were taken. At last, however, the secret is out! This clipping, taken from the advertising columns of the March, 1924, *Scientific American*, tells the story:

> CHEMISTRY
> YOUR CHEMICAL problem solved and working process furnished for FIVE DOLLARS. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

Do you blame any "captain of industry" for dispensing with an expensive research staff when he can get his chemical problem solved and a working process furnished for $5?

Perhaps it would be a good idea to send this bird $5 with one of the problems I've been burning midnight oil on and let him solve it, while I sit back and rest. I might even have time for a little golf once in a while.

RESEARCH LABORATORY,
U. S. Industrial Alcohol Co.,
By William C. Moore.
Baltimore, Md.

Important Articles in Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. A brief résumé of each article is included in the reference given. Since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

"Iodine in the Württemburg Salt Deposits and Minerals." *Karl Krafft.* Iodine found in considerable quantity in the combustion products of various minerals in the Jura Mountains. *Chemiker-Zeitung*, Jan. 26, Feb. 2, 1924.

"Inland Turpentine Production." A brief description of Russian and Polish practice. *Chemiker-Zeitung*, Feb. 6, 1924.

"Chromium Plating Using Chromium Anodes." *K. W. Schwartz.* American Electrochemical Society paper describing investigation of methods of procedure. *Brass World*, March, 1924, pp. 85-88.

"Operating Results With Waste Heat Boilers in Connection With Siemens-Martin Furnaces." *Stahl und Eisen*, Feb. 23, 1924, pp. 65-71.

"Artificial Shellac." This is being made in Munich by the Dr. A. Wacker Gesellschaft für elektrochemische Industrie (G.m.b.H.). It is made from acetylene by way of acetaldehyde, which yields first a soft resin and finally a hard shellac-like resin. "Carbide spirit" is used as solvent; hence a can of the solution contains practically nothing but converted acetylene. *Chemiker-Zeitung*, Feb. 23, 1924.

"How to Check Up on Insulation Varnishes and Their Solvents." *H. L. Hazeltine.* Practical suggestions for use of these products. *Industrial Engineer*, March, 1924, pp. 123-6.

"Magnesium Oxychloride Cement." *J. H. Paterson.* A review of history and properties. *Chemistry & Industry*, Feb. 29, 1924, pp. 215-8.

"Economic Status of the Chemical Industry in Russia, 1918-23." *A. Billaz, L'Industrie Chemique*, Feb., 1924, pp. 63-5.

"Practical Aspects of Centrifugal Driers and Separators." A résumé of the chemical engineering conference held at Hull, England, March 4, 1924. *The Chemical Age* (London), March 8, 1924.

"A Study of the Destructive Distillation of Coal." *E. V. Evans.* One of three lectures before Royal Society of Arts. This first of the series discusses the thermal relationships of carbonization and the efficiency factors involved at each stage. *Gas Journal* (London), Feb. 27, 1924, p. 483.

"Some Notes on the Lubrication of Gas Works Plant." *W. T. Kenshole.* A worth-while review of lubrication and care of plant equipment. *Gas Journal* (London), Feb. 27, 1924, p. 490.

News of the Industry

Summary of the Week

Import and export returns for February show but little changes from the totals for January.

Hardware interests favor reduction in number of shades of paint and varnishes.

Zanetti outlines 100 research problems that urgently require solution.

David J. Price, Bureau of Chemistry, is touring the West in the interest of dust explosion prevention.

Second Annual Paper Exposition to open April 7, at Grand Central Palace, New York, with many novel features.

Several universities offer scholarships in connection with prize essay contest of the American Chemical Society.

Silica gel process refinery, first in United States, approaching maximum output.

Producers of coal-tar chemicals reply promptly to questionnaire of Tariff Commission, and census figures for 1923 may be published in April.

The Treasury Department has announced that no change will be made at present in regulations governing imports of coal-tar products.

French Disagree on Method for Nitrate Production

Coincident with the decision of the French Government to manufacture synthetic ammonia in its explosives plant at Toulouse there has come to the surface in the Senate discussions what appears to be a duel to the death between partisans of the French Claude and Casale processes and those of the Haber-Badische-Anilin. The latter, by the treaty of Versailles, was to be placed at the disposition of France for whatever use her government might choose to make of it, so long as the process was kept secret.

The chief chemist and director of the French Government powder plants was one of the most vigorous opponents of the German process, stating that in the United States, after $30,000,000 had been spent, the available output was but 10 tons per day and that in England the plant erected for its production had produced nothing.

General French opinion appeared to favor the Claude process, which has already given remarkable results both in laboratory practice and in industry. The Claude process was shown to be already producing 11,000 metric tons per year in France and that of Casale a like quantity. Expectations for 1924 are for a total of 72,000 tons. French consumption is at present but 66,000 tons, a figure admittedly lower than the quantity that might be used advantageously in French agriculture.

The French industry, without employing the German process, is thus shown not only to be able to supply home demands, but to give promise of doing more in the future. Monsieur Cheron, Minister of Agriculture, arguing for an increase of 20 per cent in the wheat crop, based on areas that are now cultivated (in all 100,000,000 metric quintaux), stated that the demand would ultimately be for 120,000 tons per annum.

The final approval of the Senate was for "the exploitation of various processes of the production of nitrate under the approbation of the Minister of Finances. The organization is to be known as the Office National Industrial d'Azote, and such profits as may accrue are to be divided among the various chambers of agriculture and the Office National du Credit Agricole.

Census of Coal-Tar Products May Be Ready in April

Replies to the questionnaire submitted to producers of coal-tar products and other synthetic organic chemicals by the Tariff Commission for its census of 1923 production are being received much more rapidly than in any previous year. If four or five additional reports are received, it will be possible for the commission to issue a preliminary statement of the results some time in April, according to W. N. Watson, color expert of the Chemical Division, who is in charge of the census.

While definite conclusions have not been reached from the reports already at hand, indications are that the total production of coal-tar dyes and other products in 1923 will show a higher figure than in any previous year, with the possible exception of 1920, although it is not certain that even this maximum record may not be equalled.

Not only conditions in the Ruhr but a steady domestic demand from normal causes and increased exports contributed to the increased output in 1923, it is understood.

Price Touring West Discussing Dust Control

David J. Price, engineer in charge of development work in the Bureau of Chemistry, is at present making a tour of the country in the interest of prevention of dust explosions. During the past week he addressed the Kiwanis Club of Madison, Wis., the students and faculty of the University of Wisconsin, the Terminal Grain Merchants Association at Minneapolis and the engineers of the Twin Cities.

His itinerary follows:

Monday, March 31—Spokane, Wash. Noon meeting, "The Importance of Dust Explosion Prevention, With Special Reference to the Work of the Dust Explosion Hazards Committee of the National Fire Protection Association."

Wednesday, April 2—Seattle, Wash. Meeting 6: 30 p.m., Puget Sound Chemical Society, manufacturers' associations, insurance representatives. Subject, "Some Recent Types of Industrial Plant Dust Explosions."

Thursday, April 3—Seattle. Noon meeting, Engineers Club. "Some Engineering Phases of the Work of the U. S. Bureau of Chemistry on Dust Explosion Prevention."

Friday, April 4—Portland, Ore. U. S. Department of Agriculture Club. "Some Phases of the Work of the U. S. Bureau of Chemistry on Dust Explosion Prevention."

Tuesday, April 8—San Francisco, Calif. Pacific Safety Congress. Subject, "Industrial Plant Dust Explosions and Fires, With Special Reference to the Starch Explosion at Pekin, Ill."

Friday, April 11—Denver, Colo. Local engineers. Subject, "Industrial Plant Dust Explosions and Fires."

Monday, April 14—Chicago & Western Society of Engineers, "Discussion of the Investigation of the Starch Explosion at Pekin, Ill."

Second Paper Exposition Promises Novel Features

Opens in Grand Central Palace April 7 —Notable Group Exhibits—Show Larger Than Last Year's

The motion pictures of Alaska made by direction of President Harding while on his Alaskan tour will be shown for the first time in New York at the Second Paper Industries Exposition. This is one of the notable additions recorded during the past week to the program for the big paper show at the Grand Central Palace the week of April 7, during the convention week of the various paper associations. Among the films that are to be shown will be pictures portraying the manufacture of newsprint, fine papers, tissue paper and paper cups and in fact nearly every picture extant showing paper manufacture in any of its phases will be seen during the week. The detailed motion picture program has not yet been arranged, but it is certain that the "Romance of Paper" of the Butler Paper Corporation will be one of the features of the opening day's program.

Additions to Technical Program

Several additions have been made to the program previously announced for the Technical Association day at the exposition, Thursday afternoon, April 10. On this afternoon, when the American Paper and Pulp Association leaves its program open for its members to see the exposition without conflict with other programs of a busy week, the following among others will speak to the Technical Association members: H. A. Linch, Dorr Co., "The Dorr White Water Save-All"; L. M. Booth, Booth Chemical Co., "White Water Economy"; R. H. Whitney, B. F. Goodrich Rubber Co., "Special Soft Rubber Press Rolls for Paper Machines"; George H. Spencer, S.K.F. Industries, "Ball and Roller Bearings and Their Effect on the Paper Industry"; Charles A. McKeand, Seaboard Air Line, "Paper-Making Opportunities in the South"; R. E. Wooley, General Electric Co., "Uses of Electric Flow Meters in the Pulp and Paper Mill"; W. W. Spratt, Westinghouse Electric & Manufacturing Co., "Electricity and the Paper Industry"; Karl O. Kunde, Electric Tachometer Co., "Tachometers"; C. S. Hardy, William A. Hardy & Sons Co. (title not given); A. M. Goodloe, Midwest Air Filters, "The Latest Development in Air-Cleaning Equipment and Methods for Testing Its Efficiency"; A. E. Armstrong, Armstrong Machine Works, "Armstrong Steam Traps and Their Application to the Paper Industry: the Efficient Drainage of Paper Machine Driers"; Viggo Sahmel, F. L. Smidth & Co., "Short Center Belt Drives"; D. E. Batesole, Norma Co. of America, "The Use of Hoffman Roller Bearings in Paper Mill Machinery."

Three notable group exhibits are among the latest to find place on the exposition floor. The new American Association of Paper Specialty Manufacturers will have a booth as headquarters of the new organization, and during the week there will be a meeting to perfect the organization of this large group. Another group exhibit will be that of the New York Employing Printers, and a third will be a special showing by the kraft paper manufacturers.

A survey of the list of exhibitors shows that when the exposition opens Monday, April 7, there will be double last year's space devoted to the wide variety of exhibits. By that time all available space will be taken, and the entire field of paper manufacture will be thoroughly covered, from the raw material situation to the use of paper in manufactured products.

The raw materials used in the paper industry will be completely covered by the various exhibits. Control apparatus for the development of increased efficiency in the mills and specialty devices for use in unusual phases of paper manufacture will be particularly well shown.

In the field of machinery, every phase of paper manufacture will be demonstrated, with descriptions of every method of handling the raw material. No phase of the field will be neglected, and many of the exhibits will include machinery in operation. Grinders, beaters, rolls, driers and other such forms of heavy machinery will be on exhibition.

In the displays of paper there will be some unusual exhibits, one big company having taken double its space of three booths used last year. A most artistic display of fine papers for social and business use will be shown, and the same will be true in the products of the paper converters, such as bags, boxes and bottles. The Greeting Card Association will have an elaborate display of its wares in this division of the big first floor of the Grand Central Palace.

Machinery for use in the conversion of paper will also feature this section, including cutters, slitters and coating machines.

News in Brief

Tri-City Technical Council Formed—Announcement is made of the formation of the Tri-City Technical Council, composed of engineers and chemists of Moline, Ill., Rock Island, Ill., and Davenport, Ia. The societies composing the council include the American Chemical Society, Illinois-Iowa Section; the American Society of Mechanical Engineers, Tri-Cities Section; the American Society for Steel Treating, Tri-City Chapter; the Davenport Engineers Club, and the Quad-City Foundrymen's Association. The primary function of the new organization is to increase the civic activities of the technical men and organizations of the Tri-Cities.

University of Alabama Fellowships—The school of mines of the college of engineering of the University of Alabama is offering five fellowships in mining and metallurgical research in co-operation with the U. S. Bureau of Mines. The fellowships are open to graduates of universities and engineering schools who have proper qualifications to undertake research investigation. The value of each fellowship is $540 per year of 9 months beginning Sept. 1. The fellowships have been established for the purpose of undertaking the solution of mining and metallurgical problems of special importance to the State of Alabama and the Southern States. The research consists primarily of laboratory work directed by the Bureau of Mines technologists and the school of mines staff.

MacRae's Retirement Is Opposed—The Montreal Section of the Society of Chemical Industry recently passed a resolution protesting against the federal government's action in notifying A. E. MacRae, chemist of the Dominion Patent Office, that his services would not be required after March 31. The office is being abolished on the plea of economy. The society claimed in the resolution that the discharge of Mr. MacRae was not an economical move, and that his services were indispensable to the protection of patents.

Canadian Rubber Output Gains—The value of the output of Canadian rubber goods in 1922 was 20 per cent greater than in 1921. The total value of the products from twenty-four plants in 1922 was $16,955,118, as compared with $13,389,055, representing the output of twenty-three plants, in 1921.

Lime Men Meet in West Virginia—The National Lime Association will meet on May 20, 21, 22 and 23 at the Greenbrier Hotel, White Sulphur Springs, W. Va. The program will not only include a report of the activities of the association and addresses by men prominent in the lime industry, but there will also be scheduled certain special features, such as a golf tournament.

Huron Loses Cement Plant—The plant of the Huron Portland Cement Co., Merwin Ave., N. W., Cleveland, Ohio, was destroyed early March 22 by fire, entailing a loss of $100,000. The company with headquarters at Detroit, announces that the plant will be rebuilt.

New Alcohol Makers in Montreal—A new alcohol industry has recently been established in Montreal under the name of the Commercial Alcohols, Ltd. The company is using as raw material Cuban molasses imported in tank steamers and pumped directly into storage tanks on the company's property on the harbor. The capacity is 1,500 gal. of alcohol a day. A pure yeasting equipment is used for the fermenting operation, in which fresh yeast from a pure culture is prepared daily. The latest type of continuous stills is used for distilling. The process is largely automatic, so that less than twenty men are required to operate the plant.

Washington News

Regulations Governing Coal-Tar Imports Will Not Be Changed

The Treasury Department has announced officially that no change is to be made at present in the regulations governing imports of coal-tar intermediates and finished products under paragraphs 27 and 28 of the 1922 tariff act.

The following brief announcement of the decision was made from the office of McKenzie Moss, assistant secretary in charge of revenues:

"The question in regard to revising the present customs regulations governing importations of dyes, coal-tar products, etc., classified under paragraphs 27 and 28 of the tariff act of 1922, has been carefully considered by the committee on revising the customs regulations and also by the department, and the conclusion has been reached that no change should be made at this time in the present regulations."

A hearing was given domestic producers and importers by Judge Moss on Jan. 24, at which the importers urged amendment of the regulations in several respects. Domestic producers expressed satisfaction, in general, with the regulations as they stand.

After going over the record of this hearing and briefs which were submitted to supplement the testimony then taken, the committee on revision, which is codifying and rewriting all customs regulations, decided to incorporate in its report the coal-tar regulations as they stand.

Regulations Functioning Smoothly

In a memorandum submitted to Assistant Secretary Moss by a member of the committee on revision as representing the views of that body, it was stated that the coal-tar import regulations have caused no more difficulty than any other new administrative measure and that administration is running more smoothly as experience is gained. It was pointed out that the majority of the appraisals are made without protest from importers and that the appraisers have been upheld by the Board of General Appraisers in the majority of cases in which protests were lodged by importers. The coal-tar paragraphs of the tariff act cannot be considered merely as units of the tariff, but the evident intent of Congress to afford a greater measure of protection to this domestic industry in order to strengthen it to further the national defence in the event of war must also be considered, the memorandum states.

Memorandum on Proposed Changes

On the three specific changes requested by the importers, the memorandum states:

Hearings before a dye is changed from the non-competitive to the competitive list are unnecessary and without authority of law.

To grant 30 days grace before a decision transferring a color from one list to the other became effective is not authorized by law, despite the general practice of granting this period in changing classifications of other commodities, and would give opportunity for large importations to be shipped from abroad and entered before the period of grace expired, perhaps to the detriment of the domestic industry.

To permit entry "by regulation" and to give importers information as to United States values is not authorized by law, the entire custom of giving importers of other commodities information as to values, which was built up during the war because of extraordinary disturbance of markets, being criticized by the memorandum as illegal, and its extension to include coal-tar products being specifically opposed.

Sulphate of Ammonia Prices Fixed in Great Britain

Assistant Trade Commissioner William M. Park in a report from London says that practically all of the producers of ammonium sulphate in Great Britain, of which there are a large number, are members of the British Sulphate of Ammonia Federation, Ltd., London. The federation controls the price, and for domestic agricultural uses the following prices were fixed: December, £14 16s. per ton; January, £15 2s. per ton; February, £15 3s. per ton; March, £15 5s. per ton.

These prices are based on an ammonium content of $25\frac{3}{4}$ per cent, transportation paid to consumer's nearest railway station in lots of 4 tons upward, with an allowance of 10 shillings per ton to dealers. The works belonging to members of the federation are so situated geographically as to permit supplying the agricultural interests with ammonium sulphate from plants within a very short distance of their farms. The entire home demand is supplied without any importations and a large surplus production is available for export.

Co-operative Purchasing Measure Opposed by Importers

If the Capper bill, providing for the co-operative purchasing of raw commodities produced principally in foreign countries, becomes a law, its proponents will have to overcome not only the opposition of the agents engaged in the importation of these commodities but that of importing agents as a whole, it is believed. There are evidences that a very determined fight will be made on this measure, prompted, in part, by the fear that it would be extended to apply to many other commodities that are purchased abroad.

As the bill stands, very few importing agents would be hurt, due to the fact that relatively few American citizens are engaged as the agents of the foreign interests controlling the few commodities this legislation is intended to cover. There is apprehension, however, that this is simply an entering wedge for the extension of co-operative purchasing to a wide range of commodities.

In this connection it is pointed out that the need for protecting American consumers against the exactions of foreign monopolies is such that the blocking of legislation to allow private industries to make their overseas purchases on a co-operative basis might be followed by an effort to vest such authority in government agencies. Such a proposal applying to nitrate of soda is already before Congress and has considerable support. The success that has attended the functioning of the Reparations Commission could be cited as a comparable activity to indicate that certain commodities could be purchased by a government agency to advantage were there an acute need to safeguard the interest of the public. It would be only a step from nitrate of soda to potash purchases and only a step further to extend the activity to henequen. Such action has been urged in the past to meet the valorization of coffee by Brazil.

Potash Deposits Discovered in Western Texas

The discovery of fairly rich potash salts in drill cuttings taken from two new wells in southwestern Reagan County, Texas, has just been announced by the Department of the Interior. These two wells, which lie close together, are known as the Santa Rita wells Nos. 2 and 3. Santa Rita well No. 1, a report on which has already been made, is in section 2, block 2, Reagan County; well No. 2 is 800 ft. west of No. 1, and No. 3 is 800 ft. north of No. 2.

Chemical tests made by the United States Geological Survey of cuttings from these wells show that the drill penetrated beds containing potash at depths between 1,181 and 1,687 ft. Beds that are possibly relatively thin or of low grade were found at depths between 1,181 and 1,210 ft. Thicker or richer deposits were found somewhere between depths of 1,275 and 1,325 ft. Considerable percentages of potash were found in cuttings taken between 1,393 and 1,445 ft. and as much as $3\frac{1}{2}$ per cent was found in material brought up from depths between 1,480 and 1,560 ft. Indications of potash were found in beds lying between depths of 1,620 and 1,687 ft.

Cuttings from the Santa Rita well No. 3 brought up in the bailer from depths of 1,305 to 1,325 ft. contained 9.75 per cent of potash, equivalent to 14.17 per cent of potash in the soluble salts, and cuttings from both wells taken between 1,275 and 1,305 ft. contained a small percentage of potash, from which it may be inferred that a thin layer lies above a thicker layer somewhere between 1,275 and 1,305 ft. If the deposits in the entire interval between 1,305 and 1,325 ft. are actually so rich as the analyses indicate, the beds thus discovered should be of great commercial value.

Chemical Imports Last Month, $14,752,856

Export Trade Was Approximately the Same in Valuation as in January

Imports of chemicals during February continued at approximately the same high level that characterized the import movement during January. Free-list chemicals valued at $12,048,100 were imported during February, in addition to $2,704,756 of dutiable chemicals. In each case this represents a slight decrease from the January movement. The importations of coal-tar chemicals during February were valued at $2,549,790, substantially a continuation of the January volume of these imports.

Paints, pigments and varnishes to the value of $231,813 were brought into the country during February. This represents a slight increase over the January movement and over that of February, 1923. Fertilizers to the extent of 238,341 tons were imported in February. While this is 27,000 tons less than the January movement, it is 100,000 tons greater than the movement in February of 1923. Cyanamide to the extent of 14,304 tons was imported in February, which is an increase of 5,000 tons. The imports of sodium nitrate, however, decreased by 10,000 tons. The February total was 149,603 tons.

	Feb., 1923	Feb., 1924
White arsenic, lb.	2,115,339	1,545,024
Citric acid, lb.	15,904	183,120
Formic acid, lb.	123,124	266,638
Oxalic, lb.	157,279	473,877
Tartaric, lb.	44,921	374,444
Copper sulphate, lb.	......	600,224
Carbonate of potash, lb.	687,563	451,121
Chlorate of potash, lb.	......	934,973
Cyanide of soda, lb.	2,633,133	2,309,353
Ferrocyanide of soda, lb.	115,487	229,490
Nitrite of soda, lb.	465,197	337,441
Nitrate of soda, tons	86,302	149,603
Creosote oil, gal.	5,530,443	11,696,713
Naphthalene, lb.	850,608	1,611,746

The February figures show that exports continued during February at approximately the January rate. The value of all exports of chemicals and allied products was $9,575,029. Of that total $1,283,024 was represented by coal-tar exports. In the latter case, this represents a very substantial increase over January.

There was a slight decline in exports of sodas and sodium compounds. The total movement in February was 26,490,871 lb., a decrease of about 2,000,000 lb. On the other hand, there was an increase in the value of pigments, paints and varnishes exported. The value of these exports in February was $1,374,268 an increase of nearly a quarter of a million dollars, as compared with January, and even a more substantial increase as compared with February of 1923.

The export of fertilizers and fertilizer materials in February shows a slight increase. The total was 86,942 tons. This compares with 85,200 tons in January and 72,313 in February of 1923. The slump in the export of explosives in February was decided. The total exports in that group amounted to 1,586,377 lb. In January they were a million pounds greater.

The figures are taken from the compilation made by the Department of Commerce from the returns from all of the customs districts throughout the country.

	Feb., 1923	Feb., 1924
Benzol, lb.	5,637,621	770,277
Acetate of lime, lb.	1,553,355	1,118,977
Bleaching powder, lb.	3,726,251	2,071,947
Chlorate of potash, lb.	39,397	12,437
Bichromate of potash, lb.	361,321	149,310
Cyanide of soda, lb.	210,780	960,380
Sulphate of ammonia... tons	12,084	11,727
Soda ash, lb.	2,236,226	1,803,668
Caustic soda, lb.	7,405,064	7,814,591
Sulphuric acid, lb.	438,458	848,933

Silica Gel Process Refinery Developing Full Output

The Royal Dutch Shell Co., San Francisco, Calif., is developing maximum capacity at its new oil refinery at New Orleans, La., recently placed in service, representing the first commercial refining plant in the world to use the silica gel process, developed by the Davison Chemical Co., Baltimore, Md. It is said that all claims made for the process have materialized under regular operating service.

The refining plant was commenced last July, with contract calling for the erection of four additional plants for the same company, if the New Orleans refinery proved successful. It has a rated capacity of about 1,500 bbl. of gasoline per day. Work on the next refining unit will be started at an early date, it is stated, under the direction of the Silica Gel Corporation, which is now building five other plants of this character. One of these is for the Vacuum Oil Co., at Paulsboro, N. J., and the four others are for foreign oil interests, three in the vicinity of London, England, and one in India. It will be well toward the close of the year before any of these refineries are ready for production. The Davison company has been operating a small refining plant of this type at Curtis Bay, Baltimore, primarily for experimental work, with output of about 40 bbl. per day.

Further Reduction Sought in Number of Shades of Paints

Renewed efforts probably will be made by the National Retail Hardware Association at a later date to bring about a substantial reduction in the number of shades of paints and varnishes below the number adopted as a "recommendation of recognized practice" at a meeting of interests involved which was held with the division of simplified practices of the Department of Commerce March 13.

Representatives of the hardware association declined to vote on the recommendations submitted to the conference of producers, distributors and consumers of paints and varnishes March 13, not because they did not agree with the recommendations but because they desired further simplification, particularly a reduction of the variety of outside house paints from 32 to 26.

Inasmuch as the division of simplified practices functions as a point of contact among elements of industry in furthering simplification and standard practices and does not attempt to force an issue on these subjects, acting more upon invitation than upon initiative, it is not considered likely that the division will take further steps toward paint and varnish simplification until developments occur that logically will bring it into the situation.

The recommendation of recognized practice agreed upon at the conference in Washington March 13 provided simplification as to sizes of containers and included a maximum list of shades and tints which it was said also would have the effect of simplification by making an actual reduction, if followed by all producers, some of whom now put on the market a greater variety than contained in the list adopted. The reduction in shades and tints was estimated at approximately 10 per cent, while it was calculated that through elimination of certain sizes and types of containers there would be a reduction of about 15 per cent in this phase of the question.

It was decided that the recommendation shall become effective Sept. 1, 1924, and shall be subject to annual revision.

Several Universities Assist A.C.S. Prize Contest

Announcement of several scholarships that have been donated by various universities to be given as awards in the American Chemical Society's prize essay contest now being conducted in high schools and secondary schools all over the United States has recently been made. These scholarships are in addition to the six 4-year tuition scholarships to Yale University and Vassar College given by Mr. and Mrs. Francis P. Garvan of New York.

The universities granting the scholarships are: The University of Arizona, which gives two scholarships remitting all fees; The University of Iowa, one scholarship; the University of Kentucky one, and one from the University of Mississippi. In South Dakota the Northern Normal and Industrial School at Aberdeen offers a prize of $25 for the best essay submitted in the state. In Texas the Baylor College for Women offers a scholarship to a prize winner worth $120, and the University of Texas also offers a tuition scholarship worth $120. The University of Utah has contributed a tuition scholarship and Washington and Lee University in the State of Virginia is offering a tuition scholarship worth $80.

The Catholic University of America has announced through its rector, the Right Reverend Bishop Thomas J. Shahan, that it will grant a 4-year tuition scholarship worth $1,200. In addition to these scholarships it is believed that Georgetown University, Cornell University, Massachusetts Institute of Technology, Maryland University, Columbia University and other institutions all over the country will grant scholarships to successful contestants.

Alberta Has Much Pulpwood

At a hearing of the Royal Commission inquiring into the pulpwood situation in Canada, it was reported that there are in the Province of Alberta 60,000 square miles of marketable timber and 12,000,000 acres of forest reserve.

Zanetti Prepares Outline of Necessary Research

Results of Questionnaire Summarized 100 Problems Urgently Requiring Solution

Directors of research in the laboratories of the country's largest industries have co-operated with the division of chemistry and chemical technology of the National Research Council in preparing a list of 100 research problems bearing upon industrial progress and for which investigators are now trying to find solutions.

The list, made public by the American Chemical Society in announcing the program for its annual meeting in Washington April 21 to 26, was prepared by Prof. J. E. Zanetti of Columbia University, chairman of the division. It indicates amazing expansion of research in America, particularly since the war.

"The list of research problems," Professor Zanetti explained, "is intended to call the attention of investigators to pressing questions that need solution, rather than to stimulate new recruits to the field of research with inspiring problems. Only a very few are capable of that. Much can be accomplished, however, to forward the interests of research by calling attention, from time to time, to the lack of certain information that is desired, not only by the industries, but by investigators in general. At least, co-operation of effort may thus be secured.

"These problems were supplied from various sources. The Mellon Institute of Industrial Research supplied from its files a number of problems awaiting solution. Directors of research of some of the largest industrial laboratories have contributed a very large number to this list. Some were supplied by individual investigators.

Co-operation With Industry Secured

"It is not claimed that this list gives a representative set of research problems from the chemical industry in general. Industrial laboratories are naturally cautious and are loath to let it be known what line of work they may be pursuing. It was felt, and experience proved the assumption to be correct, that a circular letter asking for problems would meet with little response; hence resort was had to direct personal appeal. By explaining to some of the heads of industrial laboratories the purposes of the division of chemistry and chemical technology, their co-operation was secured.

"The division agreed not to disclose the source of the problems unless express permission was granted by the laboratory supplying the problem. In most cases, however, the heads of these laboratories expressed the desire to help in every way, with materials and information, investigators who would take up the problems they had supplied.

"The division will keep a record of these problems, and if those who undertake their solution will notify the chairman of the division to that effect, their names will be entered in its list and other investigators who may wish the same problem will be notified of those known to be working in the field. Of course, the division cannot guarantee to assign any problem. It is possible that work may be in progress on some of these problems and that specialists may know of others that have already been solved."

Forty-five of the 100 problems deal with physical chemistry, eleven with electrochemistry, five with corrosion, nine with rubber, one with paper, four with paints and varnishes, seven with inorganic and eleven with organic chemistry, and seven with cellulose and nitrocellulose.

New Company to Manufacture Butyl Alcohol

The Carbinol Products Co. has been formed to engage in the manufacture of butyl alcohol and acetone. The company is incorporated under the laws of Delaware with an authorized capital of \$2,500,000, consisting of 25,000 shares of 10 per cent cumulative preferred stock and 25,000 shares of common stock of no par value. Of the preferred stock, \$1,000,000 has been subscribed by E. I. du Pont de Nemours & Co., Atlas Powder Co., Maas & Waldstein Co., Eastman Kodak Co. and Egyptian Lacquer Manufacturing Co. Each of these companies is represented on the board of directors, the directors being: William P. Allen, Leonard Richards, Jr., Henry V. Walker, James H. Haste and Paul Ruckgaber.

The newly formed company has acquired basic patents covering the production of butyl alcohol and acetone and will build a plant which is expected to be in operation in about 6 months.

Calendar

American Chemical Society, annual meeting. Washington, April 21 to 25.

American Electrochemical Society, Hotel Bellevue-Stratford, Philadelphia, April 24 to 26.

American Institute of Chemical Engineers, Denver, Colo., July 15 to 18.

American Leather Chemists Association, Spring Lake, N. J., June 18 to 20.

American Paper and Pulp Association, including T.A.P.P.I., Waldorf-Astoria, New York, April 7 to 11.

American Paper and Pulp Mill Superintendents Association, Dayton, May 22 to 24.

American Physical Society, Washington, April 25 to 26.

American Society of Mechanical Engineers, Cleveland, Ohio, May 26 to 29.

American Society for Steel Treating, Moline, Ill., May 22 to 23.

American Society for Testing Materials, Atlantic City, June 23 to 28.

American Welding Society, Engineering Societies Bldg., New York, April 22 to 24.

National Association of Purchasing Agents, Boston, May 19 to 24.

National Fire Protection Association, annual meeting, Atlantic City, N. J., May 13 to 15.

Paper Industries Exposition, New York, April 7 to 12.

World Power Conference, London, June 30 to July 12.

Society of Industrial Engineers Buffalo, April 30 to May 2.

Society for Promotion of Engineering Education, Boulder, Colo., June 25 to 26.

Company Reports

Improvement in demand for iron and steel products, which developed in the fall of 1922, continued in very satisfactory volume until June, 1923, following which there was for several months a decided diminution in the amount of new business offered, says the annual report of the United States Steel Corporation. At the close of 1923 the tonnage of unfilled orders for various classes of rolled steel products was 4,445,339, compared with 6,745,703 tons at the close of the preceding year. The subsidiary companies were enabled to operate on an average during the year at 88.3 per cent of capacity, the output during the first half of the year reaching 92.6 per cent. In point of total tonnage output of materials produced for sale the year 1923 has been exceeded in only two previous years, 1916 and 1917. As a result of these larger operations, together with improved selling prices, earnings show a substantial increase over those of the preceding two years.

Production of coke by subsidiary companies, according to the report, amounted to 18,837,631 tons, of which total 11,694,730 tons was produced in byproduct ovens and 7,142,901 tons in beehive ovens. This compares with a total of 13,237,058 tons in 1922. Sulphate of iron production in 1923 amounted to 36,079 tons, against 32,389 tons in the preceding year. Sulphate of ammonia output by the corporation was 150,000 tons, compared with 123,118 tons in 1922. Ammonia liquor production in 1923 reached the total of 2,528 tons, compared with 3,816 tons a year ago. Fertilizer (basic phosphate) was produced to the extent of 15,748 tons, against 16,513 tons in the preceding year. Benzol products production amounted to 143,312 tons, compared with 119,373 tons in 1922.

The Universal Portland Cement Co., a subsidiary, produced 14,440,000 bbl. of cement in 1923, compared with 13,168,000 bbl. in the preceding year.

The report of the United States Gypsum Co. for the past year shows that the company has made large expansion in productive capacity in last few years and now has plants in all parts of the country. Recent acquisition of the J. B. King interests, for which \$3,000,000 in preferred and \$500,000 in common stock was given in payment, has insured a wider distribution of its products in New York and New England States. New \$1,000,000 plant at Sweetwater, Tex., now under construction, will be soon in operation and new addition to plant in Virginia is expected to be in operation about May 1.

President Du Bois, in his annual report on the status of the Western Electric Co., stated that the increase in the number of employees of the company indicates the rapid expansion of its business. There are approximately 64,000 employed, against 27,584 in 1919. Of the \$255,177,000 sales in 1923 the Bell Telephone companies took \$185,969,000, an increase of 17 per cent over their business in 1922.

Men You Should Know About

R. A. ALLEN, of Springfield, Mass., metallurgist at the plant of the Rolls-Royce of America and past vice-president of the American Society for Steel Treating, gave an illustrated lecture before the members of the Boston chapter of the organization at the factory of the Trimount Manufacturing Co., Roxbury, March 21, on the subject of inspecting and testing materials.

HERBERT B. BALDWIN, city chemist of Newark, N. J., will retire from active service on a pension April 1. He has acted in this capacity for more than 30 years.

BRUCE K. BROWN, formerly with the Burgess Laboratory, is now in charge of research information and patent departments of the Commercial Solvents Corporation, Terre Haute, Ind.

Dr. H. C. CHEETHAM, of the Redmanol plant, has been transferred to the laboratories at Bloomfield, N. J., where he will direct some experimental work on a large scale.

Dr. JOHN JOHNSTON, Sterling professor of chemistry, Yale University, spoke before the Franklin Institute March 27, on "Solubility Relations of Organic Compounds."

R. H. KELLNER, formerly in the employ of the City of St. Louis, Mo., is now connected with the Bakelite Corporation, Painesville, Ohio.

WILLIAM A. KINGMAN, formerly a chemist for the Dennison Manufacturing Co., Framingham, Mass., is now a director of the laboratory of the Multibestos Co., Walpole, Mass., manufacturer of automobile brake linings, clutch facings and similar asbestos products.

GILBERT NEWTON LEWIS, professor of physical chemistry in the University of California, has been elected by the jury of awards to receive the Willard Gibbs medal, the presentation of which and address by Dr. Lewis will take place at the April meeting of the Chicago Section of the American Chemical Society.

Colonel U. G. LYONS, president of the Conewango Refining Co., Warren, Pa., has been elected chairman of the board of directors of the Fred G. Clark Co., Cleveland, Ohio, petroleum refiner, which is largely interested in the Conewango company. Colonel Lyons is also president of the National Petroleum Association.

Dr. J. H. MUELLER, of the Townes Scientific School, University of Pennsylvania, gave a technical lecture on germanium before the members of the Delaware Section of the American Chemical Society and invited guests at the Hotel du Pont, Wilmington, March 19.

E. L. ORNDORFF has been appointed chief chemist of Wilson & Co.

RICHARD PENFIELD has recently resigned his position with the research and development department of the Grasselli Chemical Co., Cleveland, and is now chemical engineer with the American Cellulose & Chemical Manufacturing Co., located at Amcelle, near Cumberland, Md.

Dr. L. V. REDMAN is planning to move from Chicago to Caldwell, N. J., in order to be in closer touch with the research laboratories of the Bakelite Corporation at Bloomfield, N. J., and with the main office of the corporation in New York.

Dr. ALBERT SAUVEUR, professor of metallurgy, Harvard University, gave a lecture before a large audience of metallurgical engineers, chemists and others in the Bureau of Mines building, Pittsburgh, Pa., March 20, on the subject "The Behavior of Steel Under the Action of Heat," illustrated with a number of pertinent lantern slides. Dr. Sauveur was the guest of honor at a luncheon on the same day at the University of Pittsburgh Faculty Club, at which Dr. Alexander Silverman, dean of the School of Chemistry, presided. During the afternoon he was conducted on a tour of inspection through the Homestead works of the Carnegie Steel Co.

Dr. LUDWIK SILBERSTEIN, of the Eastman Kodak Co. research laboratory, Rochester, N. Y., delivered an address Feb. 23, before the Royal Canadian Institute in Toronto, on "Is Our Universe Infinite or Finite?" in which he gave a popular presentation of his recent investigations on the value of the curvature radius of space-time.

MAYNARD D. SMITH has been elected president and general manager of the New Egyptian Portland Cement Co., Detroit, Mich. E. R. SULLIVAN has been elected vice-president and general sales manager, C. A. BRAY secretary and treasurer, and JOHN A. ACKER assistant general manager.

HOMER F. STALEY, manager of the ceramic department, Metal & Thermit Corporation, New York City, addressed a meeting of the Rutgers Ceramics Club, composed of students in the ceramics department at Rutgers College, New Brunswick, N. J., on March 20, on the subject "Some Chemical and Physical Properties Involved in the Enameling of Metals."

RICHARD STRATTON, manager of the plant of the Giant Powder Co. at San Francisco, Calif., is now in the East on a business trip.

NEAL THURMAN has joined the staff of the varnish and auto finish laboratory of the du Pont company, Wilmington, Del.

L. M. TOLMAN, technical director of Wilson & Co., has been made vice-president of the Central Chemical Co., an affiliated company manufacturing sulphuric, nitric and hydrochloric acids.

RALPH GIBBS VANNAME has been appointed a member of the faculty at Yale University, New Haven, Conn., as associate professor of chemistry. KENNETH C. HEALD, heretofore chief of the gas and oil section of the U. S. Geological Survey, has been appointed associate professor of geology at the Sheffield Scientific School. HILDA M. CROLL has been appointed instructor in physiological chemistry.

L. P. WHITING, formerly of the Dearborn Chemical Co., has entered the employ of the Bakelite Corporation. He will be engaged in starting a phenol products plant at Painesville, Ohio.

Obituary

Colonel H. RIEMAN DUVAL, president of the American Beet Sugar Co. for the past 17 years, died on March 18 at St. Augustine, Fla., aged 81 years. He was born in Baltimore, Md., on Oct. 17, 1843, and served with the Confederate forces in the Civil War. At the time of his death he was a director of a number of large companies, including the American Car & Foundry Co. He is survived by a son, Hanson R. Duval, and a daughter, Mrs. J. H. Wilcox.

RUDOLPH A. LOW, until recently, upon retirement, president of the United States Reclaiming Co., New York, died in Paris, France, March 18, where he had been hoping to recuperate from an illness since last July. He was 70 years of age and was reputed to be one of the greatest authorities on rubber in the United States. He came to this country from Germany when a boy. Mr. Low is survived by his wife, one son and two brothers.

THOMAS SOUTHWORTH, managing director of the Deloro Smelting & Refining Co., Ltd., Deloro, Ont., died on March 9.

Production of Bauxite in 1923

The production of bauxite in the United States in 1923 was 522,690 long tons, valued at $3,156,610, an increase of more than 72 per cent in quantity and 56 per cent in value as compared with the domestic production in 1922, according to a statement prepared by James M. Hill, of the Geological Survey.

Bauxite produced and consumed in the United States 1922-1923, in long tons

Year	Domestic Production	Imports	Exports*	Apparent Consumption
1922	309,600	23,656	19,617	313,639
1923	522,690	119,020	78,560	563,150

* Largely bauxite concentrates.

Domestic bauxite consumed by industries, 1922-1923, in long tons

Year	Aluminum	Chemicals	Abrasives and Refractories	Total
1922	211,550	78,550	19,500	309 600
1923	380,518	68,872	73,300	522,690

In the Arkansas field the production increased from 266,790 long tons in 1922 to 493,880 long tons in 1923, but the production in the Eastern field declined from 42,810 long tons in 1922 to 28,810 long tons in 1923. The greatest decrease occurred in the Alabama districts, for the production of both Georgia and Tennessee was greater in 1923 than in 1922.

Market Conditions

Moderate Improvement in Demand for Chemicals and Allied Products

Consumers Show More Interest in Filling Requirements for April— Contract Deliveries of Good Volume

MORE interest on the part of consumers was reported last week with buying largely for April delivery. Deliveries against old orders are being made regularly and reach a fair total although the trade in this respect has hardly come up to expectations in the past month.

The weather report showed an unfavorable week in the south for agricultural work and this is a factor in holding down demand for fertilizer and agricultural chemicals. However, there was a better inquiry for calcium arsenate and the market revealed a better tone in spite of the fact that trading was restricted because the majority of bids was below the prices asked by sellers. The position of manufacturing industries has not been improved and this prevents any active call for chemicals and other raw materials.

Price changes for the week were not numerous but the weighted index number declined under the influence of lower price levels for linseed oil and for some of the chemical selections. The general price average for chemicals and allied products, as measured by the weighted index number, shows a decline of about 10 per cent from the general level of a year ago.

Official figures received last week indicate that export and import trade in chemicals in February continued very closely along the lines established in the preceding month. While some important chemicals suffer in comparison with the outward movement for the corresponding period of 1922, the totals for both exports and imports indicate that these branches of the trade are holding up well and the figures are still more favorable if consideration is given to the fact that comparison is made on a basis of total valuations where the unit value is lower this year than it was in the corresponding period of last year.

Acids

Generally considered the market for acids was quiet. There is a fairly large movement against contracts but new business, with few exceptions, was light. Import figures show that arrivals of foreign made acids were larger than in February last year. This is true of citric, formic, oxalic, and tartaric. Most of these acids have been easy in price but interest in citric and tartaric has been gaining and values during the week were on a more stable basis. Oxalic continues under pressure and in some cases the imported material was competing with domestic acid. The decline in acetate of lime has given an easier tone to prices for acetic acid.

Mineral acids are suffering from weight of unsold stocks and prices are easy accordingly. The quoted prices do not vary much but buyers of large amounts can do business on private terms. Export call for sulphuric acid is reported to have increased and this is borne out by the fact that shipments abroad in February were 848,933 lb. as compared with 438,458 lb. in February last year.

Acetate of Lime Lowered — Acetone Declines 2c. per lb.— Arsenic Easier for Shipment — Barium Products Firmly Held—Calcium Arsenate More Active — Sal Ammoniac Firm —Prussiate of Soda Easy— Caustic Potash Weaker.

Potashes

Bichromate of Potash—Large lots are not commanding attention and a quiet week was reported. Prices are steady with an absence of selling pressure. Quotations are 9½@9¾c. per lb. with the range depending on quantity and seller. Exports in February were 149,310 lb. as against 361,321 lb. in February last year.

Caustic Potash—It appears to be difficult to bring about any sustained advance in this material. According to some reports, markets abroad have been firmer in recent weeks and some holders of spot goods have asked 6¾c. per lb. and upward for this material. However, there are offerings on spot at 6⅝c. per lb. and the same figure is quoted for shipments. Domestic caustic remains at a premium over the imported and preference is given to the latter.

Chlorate of Potash—Imported chlorate is arriving in quantities large enough to take care of all consuming requirements. This is shown from the statistics for February, which show that arrivals from abroad amounted to 934,973 lb. Large consumers are well covered ahead and the bulk of imports pass directly to them. Spot offerings are held at 7¼@7½c. per lb.

Permanganate of Potash—Domestic makers continue to offer at 14c. per lb. at works and spot holdings of imported permanganate are offered at the same figure. Shipments from abroad are out of line and business is restricted to spot trading.

Prussiate of Potash—Importers are firm in their views and yellow prussiate is quoted at 20c. per lb. on spot. For shipment 18½@19c. per lb. is asked. Demand is quiet. Red prussiate is slow at 42@43c. per lb.

Sodas

Bichromate of Soda—Sellers report a good movement against contracts with scattered buying on the part of consumers who are not covered ahead. Producing costs are holding up with no change in chrome ore and values for bichromate are steadily maintained at 7½@7¾c. per lb.

Caustic Soda — Exports of caustic soda in February were 7,814,591 lb. as compared with 7,405,064 lb. in February, 1923. For the 8 months ended February exports were 73,642,387 lb. in 1924 and 72,427,943 lb. in 1923. A report from Brazil under date of Feb. 9 says that the amount of caustic soda imported from the United States in January was only 12,671 kilos, which is less than 23 long tons. The report also says that the price for caustic from England on that date was the equivalent of $3.36 per 100 lb. c.i.f. Rio de Janeiro. There has been no change in the domestic situation and the contract price remains at $3.10 per 100 lb., in carlots, at works, with $3 per 100 lb. quoted for f.a.s. delivery.

Cyanide of Soda—Imports are running heavy with arrivals of 2,309,353 lb. in February. Exports in the same month were 960,380 lb. The market shows little change from the price standpoint with quotations depending on grade. Standard domestic cyanide is held at 22@22½c. per lb.

Fluoride of Soda—Imported material has been moving in fair volume but domestic is quiet. Holdings of imported have been reduced and while reports of sales at 9c. per lb. have been heard, the general asking price is closer to 9½c. per lb.

Nitrate of Soda — Production of nitrate in Chile is gaining but recent sales also have been large and shipments are moving freely with the result that no sign of weakness is apparent at primary points. It is also stated that steps are under way for continuing the agreement among producers which terminates at the end of June. This is regarded as against the possibility of an open market from July forward. Imports of nitrate into this country in February were 149,603 tons as compared with 86,302 tons in February last year. The slow position of the fertilizer trade has created a quiet market for nitrate but spot holdings are

in firm hands and prices are steady at $2.52@$2.55 per 100 lb.

Nitrite of Soda—The higher prices which have been in effect have brought out offerings of domestic nitrite but most large consumers are covered ahead and buying in the spot market is inactive. Imports in February were 337,441 lb. as against 465,197 lb. in February last year. Asking prices are 8¼@8½c. per lb.

Prussiate of Soda — An easy tone rules in the market. Imported goods on spot were offered at 10¾c. per lb. and shipments from foreign markets were said to be easy at 10⅝c. per lb. Arrivals from abroad in February were officially placed at 229,490 lb. as compared with 115,487 lb. in February last year.

Miscellaneous Chemicals

Acetate of Lime — Leading factors have announced a decline in price for this material and are now offering at $3.50 per 100 lb. There has been a fair movement to domestic and export buyers but stocks are large and the decline in price had been expected in some quarters. Official figures place exports in February at 1,118,977 lb. as compared with 1,553,355 lb. in February last year.

Acetone—There has been considerable competition in this market. In the early part of the week the open quotation for round lots was 18c. per lb., but business was going through at lower levels and on Thursday leading sellers announced a reduction of 2c. per lb., making the price 16c. per lb. for c.p. acetone. Methyl acetone was unchanged at the old level of 90c. per gal., in tank cars, f.o.b. works.

Arsenic—The market has remained quiet but reports of a better inquiry for calcium arsenate in the latter part of the week caused a better feeling. Prices have not strengthened and sellers say spot arsenic is nominal at 11¾@12c. per lb. Japanese arsenic for late May arrival was offered at 10½c. per lb. The speculative side of the market is reported to have been complicated by the fact that some buyers have not taken deliveries in accordance with contracts. Bids for calcium arsenate were said to be under asking prices of 11¼@11½c. per lb. at works.

Barium Products—Difficulty in securing prompt shipments from abroad has had a strengthening effect on market values. Barium chloride of foreign make was held at $85 per ton on spot with deferred shipments at $76 per ton. Domestic chloride was offered at $90 per ton for prompt shipment. Barium carbonate was quoted at $67 per ton spot, imported, and shipments at $63 per ton.

Bleaching Powder—Producers are largely concerned with filling contract orders and new business in large and small lots is slow. The recently established higher price schedule is being adhered to with carlots from works held at $1.90 per 100 lb. in large drums and $2.15 per 100 lb. in small drums. Exports in February were 2,071,947 lb. which compares with 3,726,251 lb. in the corresponding period last year.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	**160.16**
Last week	160.60
Mar., 1923	178.00
Mar., 1922	156.00
Mar., 1921	157.00
Mar., 1920	252.00
Mar., 1919	233.00
Mar., 1918	281.00

Lower prices were announced for acetone, calcium acetate and linseed oil. This caused the reduction of 44 points in the week's index number.

Copper Sulphate—Imported sulphate, both large and small crystals, was offered at 4½c. per lb. for goods afloat. Shipments from foreign ports were offered at 4.40c. per lb. Domestic sulphate is quoted at 4.85@5c. per lb. Imports in February were 600,121 lb.

Ethyl Acetate—Producers announced a decline of 10c. per gal. in all grades, the market closing on the basis of $1 per gal. for the 85 per cent in drums, carload lots.

Alcohol

Demand for denatured alcohol was described as fair. Prices underwent no change, leading producers asking on the basis of 44½c. per gal., in drums, for the completely denatured, formula No. 5. The undertone was just about steady. It was reported that a new company will be formed to produce butyl alcohol. The market for butyl was more or less nominal around 30c. per lb., cooperage basis.

Methanol was inactive and price shading was reported in some quarters of the market. There was no open price reduction, leading interests asking 93c. per gal., in bbl., on the 95 per cent grade, and 95c. per gal., in bbl., on the 97 per cent material. Pure, in tank cars, settled at 90c. asked.

Coal-Tar Products

Phenol Offerings Increase—Benzene Holds Firm—Gain in Imports of Creosote Oil and Crude Naphthalene

OFFERINGS of phenol for shipment were more in evidence, and in some quarters of the market the undertone was slightly easier. Leading producers continued to quote 28c. on forward business, but other traders stood ready to take on contracts as low as 26c. per lb. The spot position was wholly nominal, prices ranging from 30@34c. per lb., depending upon the quantity and the seller. The market for benzene closed about unchanged, prices holding firm on the steady position of gasoline. Exports of benzene in February amounted to 770,277 lb. and compare with 5,637,621 lb. in February a year ago. The slump in exports is explained by the sold-up condition of the market here. Imports of creosote oil in February reached the total of 11,696,713 gal., which compares with 5,530,443 gal. a year ago. Crude naphthalene imports in February were large, amounting to 1,611,746 lb., compared with 850,608 lb. a year ago.

Intermediates were unsettled in most quarters of the trade, competition being keen. The Treasury Department announced that there will be no change for the present in the regulations governing imports of coal-tar intermediates and finished products, under paragraphs 27 and 28.

Aniline Oil and Salt—Scattered business went through on the unchanged carload basis of 16c. per lb. for aniline oil, in drums. The undertone was steady. Salt held at 22@23c. per lb.

Benzene — Distribution of benzene continues good, contracts on the motor fuel grade absorbing production. Producers report the market as firm, the 90 per cent grade holding at 23c. per gal., tank cars, f.o.b. works, prompt and forward delivery. The exports of benzene for the 8 months ended Feb. 29 amounted to 66,112,795 lb., compared with 34,946,317 lb. for the corresponding period a year ago.

Creosote—With domestic production sold up, consumers continue to buy in foreign markets. According to official figures, the imports of creosote oil for the 8 months ended Feb. 29 amounted to 53,805,564 gal., comparing with 30,429,350 gal. for the corresponding period a year ago. Manchester, under recent date, quotes creosote oil at 8½d. per gal., loose, works. Glasgow reports business at 8d. per gal., works.

Cresylic Acid—So-called crude acid was offered at 60@62c. per gal. The market for the 95 per cent grade of refined closed nominally at 65@67c. per gal., with the 97 per cent grade at 70@72c. per gal. Prices were unsettled, with demand routine only. There were foreign offerings of 60 per cent material at 2s. 3d. per gal., prompt shipment from works, with the undertone barely steady.

Naphthalene—Believing that business will soon improve, holders' views on the refined material continue firm. Nominally the market for flake held at 6@6½c. per lb., according to quantity and delivery. Ball naphthalene was available at 7@7½c. per lb. Chips settled at 5@5½c. per lb. Crude was offered for shipment from English ports at £7@£10 per ton, the top price obtaining on good material. Imports for the 8 months ended Feb. 29 were 11,888,589 lb., against 4,213,339 lb. for the corresponding period a year ago.

Phenol—The spot market was a nominal affair as regards prices, with the undertone slightly easier. Demand has been slow and this accounts for the change in the attitude of sellers. Interest centered in nearby material. There were offerings of U.S.P. quality phenol at 29@30c. per lb., in drums, nearby positions. July shipment from works was offered at prices ranging from 26@28c. per lb., depending upon the seller.

Vegetable Oils and Fats

Cottonseed Oil Barely Steady—Linseed Declines—Trading in Coconut for Shipment—China Wood Easy—Tallow Lower

TRADING in round lots of coconut oil, extract tallow and greases took place last week, but at lower prices. China wood oil went off on pressure in futures, while linseed oil was offered quite freely for nearby delivery at concessions. Crude and refined cottonseed oil prices moved in a narrow way, with the undertone barely steady because of keen competition with pure lard. Palm oils sold at lower prices, reflecting weakness in tallow. There was good call for refined rapeseed oil for immediate delivery. Oleo stearine advanced on slight offerings.

Cottonseed Oil—The market did not move much one way or the other. Offerings of crude were scanty all week and this prevented bears from exerting any pressure in refined oil. Sentiment in the option market was mixed, quite a number of traders taking the stand that the visible supply of oil is not large enough to warrant lower prices. The buying of oil by actual consumers, however, showed no improvement, while lard compound business suffered because of the low position of pure lard. Crude oil in the Southeast sold at 8¼c. per lb., tank cars, mills, on Thursday, the price comparing with 8⅜c. a week ago. Bids for crude at 8⅛c., Texas, were turned down. New crop developments attracted some attention, and according to latest advices from the South the increase in the acreage may not prove as large as was predicted a short time ago, weather conditions being rather unfavorable. Crop experts now look for the increase in plantings to amount to approximately 5 per cent. Refined deodorized cottonseed oil in the New York market settled nominally at 11¼@11½c. per lb., in bbl. Lard compound was offered at 11¾@12c. per lb., carload basis.

Corn Oil—Crude corn oil sold at 8⅜c. per lb., tank cars, f.o.b. Chicago. The market was steady at the close, some traders asking 8½c., nearby positions.

Linseed Oil—Dull business resulted in offerings of linseed oil for immediate delivery at 89c. per gal., cooperage basis, a decline of 3c. for the week. April delivery was offered at 88c. in more than one quarter of the trade, and several cars sold at this figure. Futures were wholly nominal, large consumers showing no buying interest. It was reported that 85c. could have been shaded on June forward contracts, cooperage basis. Crushers were not anxious to force matters in the distant positions. There has been a weak situation in cake for future shipment and this tends to offset, to some extent, the easier market for seed. Cake for early April shipment was offered at $37 per ton, f.a.s. New York, with late April at $35 per ton and summer positions at $33 per ton. The Northwestern seed markets were unsettled, reflecting weakness in other grains. Stocks at Minneapolis, Duluth and Canadian terminals are larger than a year ago. Receipts of flaxseed at Minneapolis and Duluth since the beginning of the crop year amounted to 13,750,000 bu. Receipts at Canadian shipping centers amounted to 3,550,000 bu. since Sept. 1, 1923. Shipments of Argentine seed to all countries from Jan. 1 to date amounted to 22,000,000 bu., while stocks at Argentine ports a week ago were estimated at 7,200,000 bu. April shipment Argentine seed was offered at $1.87 per bu., c.i.f. N. Y. News from India received here last week was conflicting, one report stating that the new crop would be larger than last year, while another had it that production may not provide for an exportable surplus of 12,000,000 bu.

Palm Oil Shipments From Nigeria Increase

The exports of palm oil and palm kernels from Nigeria during 1923 exceeded the exports for 1922 by 11,298 tons and 44,351 tons, respectively. Because of low prices the exports of peanuts fell off, oil mills buying sparingly. The outlook for peanut shipments for 1924, according to Sir Hugh Clifford, president of the Legislative Council of Nigeria, is good and promises to rival 1920.

Exports of palm oil, palm kernels and peanuts from Nigeria for the past 5 years follow:

	Palm Oil Tons	Palm Kernels Tons	Peanuts Tons
1919	100,967	216,913	39,334
1920	84,856	207,010	45,409
1921	52,771	153,354	50,979
1922	87,609	178,723	23,890
1923	98,907	223,074	22,887

China Wood Oil — The market developed further weakness on liberal offerings of futures. Buying was moderate at all times. Spot oil closed at 17@17½c. per lb., in bbl., according to quantity. On the Pacific coast prompt shipment oil sold at 16c. per lb., in tank cars, with futures at 15½c. per lb., same basis.

Coconut Oil—A round lot of Manila oil sold for shipment on the basis of 8c. per lb., in bulk, c.i.f. New York. Prompt shipment Ceylon type oil was offered at 8⅝c. per lb., tank cars, f.o.b. New York, a decline of ⅛c. On the Pacific coast sales went through at 8c. per lb., tank cars, deliveries to extend over the remainder of the year. Manila sundried copra held at 4⅞@5c. per lb., c.i.f. Pacific coast ports, according to position.

Olive Oil Foots—Prime green Italian foots held at 9¾@10c. per lb., with the market steady.

Palm Oils—Prices unsettled and easy on the decline in tallow. Lagos oil sold for shipment from Africa at 7.10c. per lb., c.i.f. New York. Niger was nominal at 6.70c. per lb., c.i.f. terms

Rapeseed Oil—Spot refined sold at 90c. per gal. April shipment from Hull was offered at 87c. per gal. On June shipment from abroad 79c. was asked.

Tallow, Etc. — Several carloads of extra tallow sold late in the week at 7⅝c. per lb., ex plant, a decline of ⅛c. Local soap makers were the buyers. In greases there was a fair inquiry and steady prices prevailed on good grades, the yellow closing at 6⅝c. asked. Oleo stearine sold at 9⅜c. per lb., carload basis, and later 9½c. was asked. No. 1 oleo oil was offered at 12½c. per lb., in bbl., carload basis.

Miscellaneous Materials

Antimony—Another advance occurred in antimony, Chinese and Japanese brands closing at 12c. per lb. Cookson's "C" grade was raised to 15c. per lb., immediate delivery. Chinese needle lump nominal at 8½@9c. per lb. White oxide, Chinese, 99 per cent, advanced ½c., closing at 10@11c. per lb. Inquiry good despite the recent sharp advance in prices.

Barytes—There was a fair demand for white floated and prices held at $23@$24 per ton, carload basis, f.o.b. St. Louis. Crude barytes steady at $8@$8.50 per ton, f.o.b. point of production.

Blanc Fixe—Producers offered blanc fixe at 3⅝c. per lb., carload basis. On less than carload lots asking prices ranged from 4@4¼c. per lb., cooperage basis.

Glycerine—No further changes reported, but prices generally steady. Dynamite offered at 16c. per lb., carload basis. Chemically pure held at 16½c. per lb., carload basis, f.o.b. New York territory. Crude soap lye, basis 80 per cent, offered at 11c. per lb., loose, carloads. Saponification, loose, nominal at 12c. per lb.

Naval Stores—Turpentine advanced 2c. per gal., closing at $1.04. Sellers firmed up in anticipation of better buying for the near future. Rosins less active and unsettled, the lower grades closing at $5.65@$5.75 per bbl.

Shellac—The recent advance in Calcutta steadied prices here and T.N. closed firm at 59c. per lb., immediate delivery. Trading fair, but restricted to nearby material. Bleached, bonedry, nominal at 68c. per lb. It was reported that some shipments of synthetic shellac arrived here recently from Germany.

White Lead—There was not enough change in the position of the metal to bring out any revision in prices for lead pigments. Corroders reported demand as good and prices held on the basis of 10¼c. per lb. for standard dry white lead, basic carbonate, in casks, carload lots. It was reported that pig lead sold at slight concessions from the 9c. per lb. level set by the leading interest. In other words, the lead situation is very much easier.

Zinc Oxide—The market for spelter was easier, but not to such an extent as to bring out any change in the selling schedule for the oxide. The demand for zinc oxide has been good, leading producers reporting business in the lead free on the basis of 7¾c. per lb. French process, red seal, held at 9⅝c. per lb., with the green seal at 10⅝c. and the white seal at 12c. Imported material was offered in some directions at slight concessions.

Imports at the Port of New York

March 21 to March 27

ACIDS—Benzoic—3 cs., London, H. J. Baker & Bro. **Citric**—4 bbl., London, Order; 275 csk., Palermo, Order. **Cresylic**—4 dr., Glasgow, Caldwell & Co **Cresylic**—25 dr., Liverpool, Order. **Tartaric**—2 bbl., London, Order; 50 keg, London, Order.

AMMONIUM CARBONATE — 20 bbl., Liverpool, Brown Bros.

AMMONIUM CHLORIDE—20 cs., Liverpool, Wing & Evans.

AMMONIUM PERSULPHATE—50 bbl., Antwerp, E. Suter.

ANTIMONY—200 bbl. red, Havre, Heemsoth, Basse & Co.

ANTIMONY ORE—660 bg., Antofagasta, W. R. Grace & Co.

ANTIMONY REGULUS—250 cs., London, Irving Bank-Col. Trust Co.

ARSENIC — 116 bbl., Antwerp, Order; 124 bbl., Tampico, American Smelting & Refining Co.

ASBESTOS — 200 bg., London Irving Bank-Col. Trust Co.

BONE BLACK — 909 bg., Bordeaux, Pomeroy & Fischer.

CALCIUM METALLIC—2 cs., Havre, C. Hardy, Inc.

CASEIN—2,752 bg., Buenos Aires, Order; 817 bg., Bordeaux, Equitable Trust Co.; 966 bg., St. Nazaire, Equitable Trust Co.; 417 bg., Buenos Aires, Order; 834 bg., Buenos Aires, Brown Bros. & Co.; 284 bg., Buenos Aires, Order.

CHALK—200 bg., Antwerp, Brown Bros. & Co.; 800,000 kilos, Dunkirk, J. Higman Co.; 300 bg., Antwerp, Equitable Trust Co.; 1,000 tons (in bulk), London, Kidder, Peabody & Co.; 1,095 tons, London, Taintor Trading Co.; 425 bg., Antwerp, L. A. Salomon & Bros.; 1,290 bg., Antwerp, Bankers Trust Co.

CHEMICALS—20 cs., Hamburg, Order; 1 cs., Rotterdam, Pfaltz & Bauer; 21 cs., Rotterdam, Order; 14 cs., Havre, E. Fougera & Co.; 38 dr., London, J. W. Hampton & Co.; 200 bg., London, A. Klipstein & Co.; 160 dr., London, Order.

COAL-TAR DISTILLATE — 248 dr., Liverpool, Order.

COLORS—20 csk., Hamburg, Order; 2 csk. coal-tar, Hamburg, Equitable Trust Co.; 5 csk. aniline, Hamburg, Franklin Import & Export Co.; 2 cs. aniline, Hamburg, A. Hurst & Co.; 28 cs. aniline, Genoa, Order; 20 bbl. blue, Bordeaux, Smith Chemical & Color Co.; 28 pkg. aniline, Rotterdam, H. A. Metz & Co.; 137 csk. earth, Rotterdam, C. J. Osborn & Co.; 6 csk. aniline, Rotterdam, Bank of the Manhattan Co.; 43 csk. do., Rotterdam, Kuttroff, Pickhardt & Co.; 8 pkg. do., Rotterdam, Garfield Aniline Works; 12 pkg. do., Rotterdam, Grasselli Chemical Co.; 46 csk. alizarine, Rotterdam, Kuttroff, Pickhardt & Co.

COPPER OXIDE—24 cs., Sydney, Wells & Richardson.

COPPER SULPHATE—150 csk., Hamburg, Order; 10 csk., Liverpool, Order.

CORROSIVE SUBLIMATE — 20 csk., London, Order.

DIVI-DIVI—450 bg., Maracaibo, Order.

FERROCHROME—128 csk., Gothenburg, C. Hardy, Inc.

FORMALDEHYDE HYDROSULPHATE—80 csk., Rotterdam, Kuttroff, Pickhardt & Co.

FUSEL OIL—8 dr., Cheribon, American Express Co.; 1 dr., Sourabaya, Order; 2 csk., Bordeaux, Order; 8 bbl., Antwerp, Guaranty Trust Co.

GAMBIER—259 cs., Singapore, Order.

GLYCERINE — 20 dr. crude, Antwerp, Brown Bros. & Co.

GUMS—200 cs. damar, Batavia, Chemical National Bank; 698 bg. copal, Antwerp, Order; 200 bg. arabic, London, Order; 315 bg. yacca, Adelaide, Brown Bros. & Co.; 320 pkg. copal, Antwerp, Chemical National Bank; 4 bg. copal, Antwerp, Coulier Van Houten & Co.; 239 pkg. copal, Antwerp, Order; 310 pkg. damar and 50 cs. copal, Singapore, Kidder, Peabody & Co.; 100 cs. damar, Singapore, Asia Banking Corp.; 470 cs. damar, Singapore, L. C. Gillespie & Sons; 50 cs. damar, Batavia, W. H. Scheel; 589 bskt. and 211 bg. copal, Macassar, Innes & Co.; 912 bskt. do., Macassar, France, Campbell & Darling; 202 bskt. do., Mascassar, Patterson, Boardman & Knapp; 252 bskt. and 145 bg. do., Macassar, A. Klipstein & Co.; 65 bskt. do., Macassar, M. L. Van Norden; 125 bskt. do., Macassar, S. Winterbourne & Co.; 272 bskt. do., Macassar, Equitable Trust Co.; 622 pkg. do., Macassar, L. C. Gillespie & Sons; 344 pkg. do., Macassar, Order; 28 bg. copal, London, Chemical Natl. Bank; 3,271 bg. copal, Matadi, L. C. Gillespie & Sons.

IRON OXIDE—13 csk., Liverpool, Bank of America; 9 keg, Callao, Diamond Match Co.; 20 csk., Liverpool, Order; 69 csk., Liverpool, J. A. McNulty; 43 csk., Liverpool, Bank of America.

LITHOPONE — 200 csk., Antwerp, A. Klipstein & Co.; 150 csk., Antwerp, E. M. & F. Waldo.

MAGNESITE — 102 bbl., Rotterdam, Speiden, Whitfield Co.

MAGNESIUM CHLORIDE — 353 dr., Hamburg, Brown Bros. & Co.; 49 dr., Hamburg, A. Kramer & Co.

MANGROVE BARK EXTRACT—4,000 bg. Singapore, Order.

MYROBALANS — 3,050 pkt., Colombo, Order; 800 bg., Bombay, National City Bank; 1,181 bg., Bombay, Order.

NAPHTHALENE — 967 bg., Antwerp, Order.

OILS—Cod—150 csk., St. Johns, F. S. Walton Co. **Coconut**—850 tons (in bulk), Manila, Proctor & Gamble. **China Wood**—28 bbl., London, Order. **Olive Foots** (sulphur oil)—200 bbl., Messina, Order. **Palm**—2,117 csk., Matadi, Niger Co.; 75 csk., Matadi, Irving Bank-Col. Trust Co.; 80 csk., Lagos, W. A. Leaman; 421 csk., Lome, Order; 93 pkg., Anecho, Order. **Rapeseed**—150 bbl., Manchester, Order. **Sesame**—150 bbl., Manchester, Order; 300 bbl., Liverpool, J. Bibby & Sons. **Sperm**—30 bbl., Glasgow, Order.

OIL SEEDS—Castor—25 bg., Port de Paix, W. Leaman & Co.; 150 bg., Port de Paix, Huttlinger & Struller; 4,000 bg., Santos, F. Matarazzo; 20,914 bg., Bombay, Order. **Linseed**—4,202 tons, Rosario, Order; 25,514 bg., Buenos Aires, Order; 78,056 bg., Rosario, Order; 24,648 bg., Buenos Aires Order.

PLUMBAGO—150 bbl., Colombo, H. W. Peabody & Co.; 200 bbl., Colombo, Irving Bank-Col. Trust Co.; 260 bbl., Colombo, Order.

POTASSIUM SALTS—167 bg. sulphate, Antwerp, Societe Comm. des Potasses d'Alsace; 1,000 bbl. chlorate, Hamburg, Irving Bank-Col. Trust Co.; 500 bg. muriate, Hamburg, Potash Importing Corp. of America; 500 csk. chlorate, Antwerp, Brown Bros. & Co.; 90 csk. nitrate, Rotterdam, Order; 100 keg prussiate, London, Order; 18 keg prussiate, Liverpool, C. Tennant & Sons Co.

PUMICE — 4,639 bg. lump, Canneto Pipari, R. J. Waddell & Co.; 275 bg. powdered, Canneto Pipari, C. B. Chrystal & Co.; 549 bg. and 10 csk., Canneto Pipari, Bankers Trust Co.; 150 pkg., Canneto Pipari, Order.

QUEBRACHO—4,056 bg., Buenos Aires, First National Bank of Boston; 1,063 bg., Buenos Aires, N. Y. Trust Co.; 3,063 bg., Buenos Aires, National Bank of Commerce; 9,707 bg., Buenos Aires, Order; 10,267 bg., Buenos Aires, Tannin Corp.; 2,928 bg., Buenos Aires, First National Bank of Boston.

QUICKSILVER—100 flasks, Vera Cruz, Paillon Poirier.

RED LEAD—16 csk., Rotterdam, Order.

SAL AMMONIAC—45 csk., Antwerp, A. Klipstein & Co.

SHELLAC—4,708 bg., Calcutta, Order; 650 bg. garnet lac, 354 bg. sedlac, 50 bg. sticklac and 25 bg. button, Calcutta, Order; 104 bg. garnet, Hamburg, Irving Bank-Col. Trust Co.; 25 bg., Saigon, Order.

SILVER SULPHIDE—76 bg., Antofagasta, H. P. Winter & Co.

SIENNA—47 bbl., Leghorn, Order.

SODIUM SALTS—1,000 bg. phosphate, Antwerp, Hollinghurst & Co.; 100 csk. hyposulphite, Hamburg, Order; 9 csk. prussiate, Liverpool, Order; 4,030 bg. nitrate, Antofagasta, Anthony, Gibbs & Co.; 300 cylinders chlorate, Havre, C. Hardy, Inc.; 126 csk. prussiate, Rotterdam, Order; 10 bbl. bichromate (returned), Bombay, K. A. Kabur & Co.; 8,456 bg. nitrate, Antofagasta, W. R. Grace & Co.; 17,992 bg. nitrate, Iquique, W. R. Grace & Co.; 42 pkg. prussiate, Liverpool, C. Tennant & Sons Co.; 50 keg. hydrosulphite, Liverpool, Order.

STARCH — 950 bg. potato, Rotterdam, Stein, Hall & Co.; 500 bg. do., Rotterdam, Stein, Hall & Co.; 1,300 bg. do., Rotterdam, Order.

STRONTIUM NITRATE—73 csk., Rotterdam, J. D. Lewis.

TALC—20 csk., Bordeaux, Kirchberger & Co.

TALLOW—150 tcs., Vancouver, Order.

TARTAR—200 bg., Bordeaux, C. Pfizer & Co.; 677 bg., Buenos Aires, Anglo South Am. Trust Co.

TAR — 60 bbl. candle, Genoa, W. H. Mason.

VANADIUM ORE—14,655 sk., Callao, Vanadium Corp. of America; 2,200 bg., Callao, Vanadium Corp. of America.

WAXES—62 bg. carnauba, Parnahyba, J. H. Rossbach & Bros.; 1,084 bg. do., Parnahyba, National City Bank; 45 bg. do., Ceara, Order; 132 bg. beeswax, Rotterdam, Order; 60 bg. beeswax, Antwerp, Order; 96 bg. beeswax, Liverpool, Order; 18 bg. beeswax, Havana, Order.

WOOL GREASE—90 bbl., Antwerp, Order; 20 bbl., Hamburg, Order.

ZINC OXIDE—135 bbl., Antwerp, Philipp Bros., Inc.; 125 bbl., Antwerp, Brown Bros. & Co.

ZINC SULPHIDE—2 csk., London, C. A. Sykes.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ACETIC ACID, sulphuric acid, etc. Bourgas, Bulgaria. Purchase and agency.—9576.

BICHROMATE OF SODA AND POTASH. Copenhagen, Denmark. Purchase.—9596.

CHEMICALS AND WAXES. London, England. Purchase and agency.—9620.

FERROCERIUM in levigated form. Goteborg, Sweden. Purchase.—9595.

FERTILIZERS. Canton, China. Purchase.—9591.

FERTILIZERS. Malaga, Spain. Agency.—9592.

NITRATE OF SODA and heavy chemicals. Malaga, Spain. Agency.—9592.

OILS, ESSENTIAL. London, England. Purchase and agency.—9620.

OILS, ESSENTIAL, for manufacture of perfumery. Amsterdam, Netherlands. Exclusive agency.—9593.

PAINTS AND VARNISHES, rosin and turpentine. Copenhagen, Denmark. Purchase.—9596.

SUPERPHOSPHATES in shipload lots. Goteborg, Sweden. Purchase.—9594.

SULPHATE OF AMMONIA. Hongkong, China. Purchase.—9617.

OIL, CORN AND COTTONSEED. Cape Town, South Africa. Agency.—9571.

OIL, COTTONSEED AND OLEO. Saloniki, Greece. Agency.—9561.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks	lb.	$0.16 –	$0.17
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl	100 lb.	3.38 –	3.63
Acetic, 56%, bbl	100 lb.	6.75 –	7.00
Acetic, 80%, bbl	100 lb.	9.58 –	9.83
Glacial, 99½%, bbl	100 lb.	12.00 –	12.78
Boric, bbl	lb.	.10 –	....
Citric, kegs	lb.	.46 –	.47
Formic, 85%	lb.	.13 –	.13½
Gallic, tech	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl	lb.	.12½ –	.13
22% tech., light, bbl	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½ –	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl	lb.	.10½ –	.11
Phosphoric, 50% carboys	lb.	.07½ –	.08½
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	10.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	14.00 –	15.00
Sulphuric, 66° drums	ton	19.00 –	20.00
Tannic, U.S.P., bbl	lb.	.65 –	.70
Tannic, tech., bbl	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.28
Tartaric, domestic, bbl	lb.	.30 –	....
Tungstic, per lb	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.30 –	.35
Alcohol ethyl (Cologne spirit), bbl	gal.	4.85 –	....
Ethyl, 190 p'f. U.S.P., bbl	gal.	4.81 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl	gal.	.51½ –	...
No. 1, 190 proof, special, dr.	gal.	.45½ –	...
No. 1, 188 proof, bbl	gal.	.52½ –	...
No. 1, 188 proof, dr	gal.	.48½ –	...
No. 5, 188 proof, bbl	gal.	.50½ –	...
No. 5, 188 proof, dr	gal.	.44½ –	...
Alum, ammonia, lump, bbl	lb.	.03½ –	.04
Potash, lump, bbl	lb.	.03½ –	.03¾
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.40 –	1.50
Iron free bags	lb.	2.40 –	2.50
Aqua ammonia, 26°, drums	lb.	.06½ –	.06¾
Ammonia, anhydrous, cyl	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12 –	.13
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.50 –	4.00
Antimony oxide, white, bbl	lb.	.10 –	.10½
Arsenic, white, powd., bbl	lb.	.11½ –	.12
Arsenic, red, powd., kegs	lb.	.15 –	.15½
Barium carbonate, bbl	ton	67.00 –	68.00
Barium chloride, bbl	ton	85.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½ –	.18
Barium nitrate, casks	...	.08 –	.08½
Blanc fixe, dry, bbl	lb.	.03½ –	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.25 –	2.35
Borax, bbl	lb.	.05½ –	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	3.50 –	3.55
Calcium arsenate, dr	lb.	.11 –	.11½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl	lb.	.06½ –	.07
Camphor, cases	lb.	.76½ –	.77
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.07½ –	.08
Chalk, precip.—domestic, light, bbl	lb.	.04½ –	.04½
Domestic, heavy, bbl	lb.	.03½ –	.04
Imported, light, bbl	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.04½ –	....
Contract, tanks. wks	lb.	.04½ –	....
Cylinders, 100 lb., wks	lb.	.05½ –	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks	ton	16.00 –	18.00
Copper carbonate, bbl	lb.	.18½ –	.19
Copper cyanide, drums	lb.	.45 –	.46
Coppersulphate, dom., bbl.	100 lb.	4.85 –	5.00
Imp bbl	100 lb.	4.60 –	....
Cream of tartar, bbl	lb.	.21½ –	.22
Epsom salt, dom., tech., bbl	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.10 –	1.15
Epsom salt, U.S.P., dom., bbl	100 lb.	2.25 –	2.50
Ether, U.S.P., dr	lb.	.14 –	.15
Ethyl acetate, 85%, drums	gal.	1.00 –	....
Ethyl acetate, 99%, dr	gal.	$1.15 –	....
Formaldehyde, 40%, bbl	lb.	.11 –	.11½
Fullers earth—f.o.b. mines	ton	18.00 –	20.00
Furfural, works, bbl	lb.	.25 –	....
Fusel oil, ref., drums	gal.	3.50 –	....
Fusel oil, crude, drums	gal.	2.50 –	2.75
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.95 –	1.05
Glycerine, c.p., drums extra	lb.	.16½ –	.17
Glycerine, dynamite, drums	lb.	.16 –	....
Glycerine, crude 80%, loose	lb.	.11 –	....
Hexamethylene, drums	lb.	.68 –	.75
Lead:			
White, basic carbonate, dry, casks	lb.	.10½ –	....
White, basic sulphate, casks	lb.	.09½ –	....
White, in oil, kegs	lb.	.12½ –	....
Red, dry, casks	lb.	.12 –	....
Red, in oil, kegs	lb.	.13½ –	....
Lead acetate, white crys., bbl.	lb.	.15 –	....
Brown, broken, casks	lb.	.14 –	....
Lead arsenate, powd., bbl	lb.	.18 –	.20
Lime-Hydrated, bg, wks	ton	10.50 –	12.50
Bbl., wks	ton	18.00 –	19.00
Lime, Lump, bbl	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.11½ –	....
Lithopone, bags	lb.	.06½ –	.06¾
Magnesium carb., tech., bags	lb.	.08½ –	.08½
Methanol, 95%, bbl	gal.	.93 –	....
Methanol, 97%, bbl	gal.	.95 –	....
Methanol, pure, tanks	gal.	.90 –	....
drums	gal.	1.00 –	....
bbl	gal.	1.05 –	....
Methyl-acetone, t'ks	gal.	.90 –	.91
Nickel salt, double, bbl	lb.	.09½ –	.10½
Nickel salts, single, bbl	lb.	.10½ –	.11
Orange mineral, csk	lb.	.14½ –	.15½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½ –	.09¾
Potassium bromide, gran., bbl	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½ –	.06¾
Potassium chlorate, powd	lb.	.07½ –	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.08 –	.08½
Potassium hydroxide (caustic potash) drums	lb.	.06½ –	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl	lb.	.07½ –	.09
Potassium permanganate, drums	lb.	.14 –	.14½
Potassium prussiate, red, casks	lb.	.43 –	.45
Potassium prussiate, yellow, casks	lb.	.19½ –	.20
Salammoniac, white, gran., casks, imported	lb.	.06½ –	....
Salammoniac, white, gran., bbl., domestic	lb.	.07½ –	.07¾
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl	100 lb.	1.20	1.40
Salt cake (bulk) works	ton	22.00 –	....
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y	100 lb.	3.00 –	....
Sodium acetate, works, bbl	lb.	.05 –	.05½
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½ –	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl	lb.	.04½ –	.04½
Sodium chlorate, kegs	lb.	.06½ –	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl	lb.	$0.09 –	$0.10½
Sodium hyposulphite, bbl	lb.	.02½ –	.02¾
Sodium nitrite, casks	lb.	.08½ –	.08½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl	lb.	.03½ –	.03¾
Sodium prussiate, yel. bbl	lb.	.10½ –	.12
Sodium salicylic, drums	lb.	.40 –	.42
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½ –	.03½
Sodium sulphite, crys., bbl	lb.	.03½ –	.03½
Strontium nitrate, powd., bbl.	lb.	.10 –	.10½
Sulphur chloride, yel drums.	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl	lb.	.08 –	.08
Tin bichloride, bbl	lb.	.15½ –	.16
Tin oxide, bbl	lb.	.60 –	....
Tin crystals, bbl	lb.	.39 –	.39½
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl	lb.	.05 –	.05½
Zinc cyanide, drums	lb.	.36½ –	.37
Zinc dust, bbl	lb.	.08½ –	.08½
Zinc oxide, lead free, bag	lb.	.07½ –	.....
5% lead sulphate, bags	lb.	.07½ –	.....
10 to 35 % lead sulphate, bags	lb.	.07 –	......
French, red seal, bags	lb.	.09½ –	......
French, green seal, bags	lb.	.10½ –	......
French, white seal, bbl	lb.	.12 –	......
Zinc sulphate, bbl	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl	lb.	$0.60 –	$0.65
Alpha-naphthol, ref., bbl	lb.	.70 –	.75
Alpha-naphthylamine, bbl	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	.....
f.f.c. drums	lb.	1.60 –	.....
tech, drums	lb.	70	.....
Benzene, pure, water-white, tanks, works	gal.	.25 –	....
Benzene, 90%, tanks, works	gal.	.23 –	....
Benzidine base, bbl	lb.	.80 –	.82
Benzidine sulphate, bbl	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.82 –	.85
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., carboys	lb.	.40 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl	lb.	.25 –	.26
Beta-naphthylamine, tech	lb.	.70 –	.75
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.70 –	.73
95-97%, drums, works	gal.	.65 –	.68
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.53 –	.55
Dimethylaniline, drums	lb.	.36 –	.38
Dinitrobenzene, bbl	lb.	.18 –	.20
Dinitrochlorbenzene, bbl	lb.	.21 –	.22
Dinitronaphthalen, bbl	lb.	.30 –	.32
Dinitrophenol, bbl	lb.	.35 –	.40
Dinitrotoluen, bbl	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.28 –	.30
Diphenylamine, bbl	lb.	.50 –	.52
H-acid, bbl	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl	lb.	.06 –	.06½
Naphthalene, balls, bbl	lb.	.07 –	.07½
Naphthionate of soda, bbl	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl	lb.	.25 –	.30
Nitro-toluene, drums	lb.	.13½ –	.14
N-W acid, bbl	lb.	1.05 –	1.10
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.10 –	.15
Ortho-nitrophenol, bbl	lb.	1.25 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl	lb.	.13 –	.14
Para-aminophenol, base, kegs	lb.	1.25 –	1.35
Para-aminophenol, HCl, kegs	lb.	1.45 –	1.60
Para-dichlorbenzene, bbl	lb.	.17 –	.20
Paranitraniline, bbl	lb.	.68 –	.70
Para-nitrotoluene, bbl	lb.	.58 –	.60
Para-phenylenediamine, bbl.	lb.	1.40 –	1.50
Para-toluidine, bbl	lb.	.78 –	.85
Phthalic anhydride, bbl	lb.	.30 –	.34
Phenol, U.S.P., dr	lb.	.26 –	.30
Picric acid, bbl	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	3.25 –	3.50
Resorcinol, tech., kegs	lb.	1.30 –	1.40

Resorcinol, pure, kegs	lb.	$2.05 - $2.10
R-salt, bbl	lb.	.55 - .60
Salicylic acid, tech., bbl	lb.	.32 - .33
Salicylic acid, U.S.P., bbl	lb.	.35 - ....
Solvent naphtha, water-white, tanks	gal.	.25 - ....
Crude, tanks	gal.	.22 - ....
Sulphanilic acid, crude, bbl	lb.	.18 - .20
Tolidine, bbl	lb.	1.00 - 1.05
Toluidine, mixed, kegs	lb.	.30 - .35
Toluene, tank cars, works	gal.	.26 - ....
Toluene, drums, works	gal.	.30 - ....
Xylidine, drums	lb.	.50 - ....
Xylene, pure, tanks	gal.	.37 - .40
Xylene, com., tanks	gal.	.28 - ....

Naval Stores

Rosin B-D, bbl	280 lb.	$5.65 - $5.70
Rosin E-I, bbl	280 lb.	5.70 - 5.80
Rosin K-N, bbl	280 lb.	5.90 - 6.10
Rosin W.G.-W.W., bbl	280 lb.	6.95 - 7.35
Wood rosin, bbl	280 lb.	5.80 - 5.90
Turpentine, spirits of, bbl	gal.	1.03 -.......
Wood, steam dist., bbl	gal.	.90 -.......
Wood, dest. dist., bbl	gal.	.68 -.......
Pine tar pitch, bbl	200 lb.	5.50 -.......
Tar, kiln burned, bbl	500 lb.	11.00 -.......
Retort tar, bbl	500 lb.	11.00 -.......
Rosin oil, first run, bbl	gal.	.41 -.......
Rosin oil, second run, bbl	gal.	.45 -.......
Rosin oil, third run, bbl	gal.	.47 -.......
Pine oil, steam dist	gal.	.60 - .62
Pine oil, pure, dest. dist	gal.	.55 -.......
Pine tar oil, ref	gal.	.35 -.......
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla	gal.	.30 -.......
Pine tar oil, double ref., bbl	gal.	.70 -.......
Pinewood creosote, ref., bbl	gal.	.......- .52

Animal Oils and Fats

Degras, bbl	lb.	$0.03¾- $0.05½
Grease, yellow, loose	lb.	.06½- .06¾
Lard oil, Extra No. 1, bbl	gal.	.85 -.......
Neatsfoot oil 20 deg., bbl	gal.	1.28 -.......
No. 1, bbl	gal.	.88 - .92
Oleo Stearine		.09½-.......
Oleo oil, No. 1, bbl	lb.	.12½-.... .12¾
Red oil, distilled, d.p. bbl	lb.	.08½-.... .08¾
Saponified, bbl	lb.	.08½-.... .08¾
Tallow, extra, loose	lb.	.07½-.......
Tallow oil, acidless, bbl	gal.	.83 -.......

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.15 - ....
Castor oil, No. 1, bbl	lb.	.15½-.......
Chinawood oil, bbl	lb.	.17 - .17½
Coconut oil, Ceylon, bbl	lb.	.09½-.......
Ceylon, tanks, N.Y.	lb.	.08½-.......
Coconut oil, Cochin, bbl	lb.	.10 - .10½
Corn oil, crude, bbl	lb.	.10½- .11
Crude, tanks, (f.o.b. mill)	lb.	.08½- .08¾
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½- .08¾
Summer yellow, bbl	lb.	.10½-.......
Winter yellow, bbl	lb.	.11½- .11¾
Linseed oil, raw, car lots, bbl	gal.	.89 -.......
Raw, tank cars (dom.)	gal.	.83 -.......
Boiled, cars, bbl. (dom.)	gal.	.91 -.......
Olive oil, denatured, bbl	gal.	1.25 - 1.30
Sulphur, (foots) bbl	lb.	.09½- .10
Palm, Lagos, casks	lb.	.07½-.......
Niger, casks	lb.	.06½-.......
Palm kernel, bbl	lb.	.09½-.......
Peanut oil, crude, tanks (mill)	lb.	.11½-.......
Peanut oil, refined, bbl	lb.	.14½- .15
Perilla, bbl	lb.	.14½- .14¾
Rapeseed oil, refined, bbl	gal.	.90 -.......
Sesame, bbl	lb.	.11½- .11¾
Soya bean (Manchurian), bbl	lb.	.11½-.......
Tank, f.o.b. Pacific coast	lb.	.10 -.......
Tank, (f.o.b. N.Y.)	lb.	.10½-.......

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.64 - $0.66
Menhaden, light pressed, bbl	gal.	.60 -.......
White bleached, bbl	gal.	.62 -.......
Blown, bbl	gal.	.66 -.......
Crude, tanks (f.o.b. factory)	gal.	.... -.......
Whale No. 1 crude, tanks, coast	lb.	.... -.......
Winter, natural, bbl	gal.	.75 - .76
Winter, bleached, bbl	gal.	.78 - .79

Oil Cake and Meal

Coconut cake, bags	ton	$30.00 - ....
Cottonseed meal, f.o.b. mills	ton	38.00 - ....
Linseed cake, bags	ton	39.00 - 40.00
Linseed meal, bags	ton	42.50 - 43.00

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.50 - $0.55
Albumen, egg, tech, kegs	lb.	.95 - .97
Cochineal, bags	lb.	.32 - .34
Cutch, Borneo, bales	lb.	.04½- .04¾
Cutch, Rangoon, bales	lb.	.13½- .14¼
Dextrine, corn, bags	100 lb.	3.74 - 3.94
Dextrine gum, bags	100 lb.	4.09 - 4.19
Divi-divi, bags	ton	38.00 - 39.00
Fustic, sticks	ton	30.00 - 35.00
Fustic, chips, bags	lb.	.04 - .05
Gambier com., bags	lb.	.10½- .11½
Logwood, sticks	ton	25.00 - 26.00
Logwood, chips, bags	lb.	.02½- .03
Sumac, leaves, Sicily, bags	ton	..... - .....
Sumac, ground, bags	ton	$130.00-$135.00
Sumac, domestic, bags	ton	50.00 - 55.00
Starch, corn, bags	100 lb.	3.12 - 3.22
Tapioca flour, bags	lb.	.05½- .06½

Extracts

Archil, conc., bbl	lb.	$0.16½- $0.20
Chestnut, 25% tannin, tanks	lb.	.01¾- .02¼
Divi-divi, 25% tannin, bbl	lb.	.04 - .05
Fustic, crystals, bbl	lb.	.20 - .22
Fustic, liquid, 42°, bbl	lb.	.08 - .09
Gambier, liq., 25% tannin, bbl	lb.	.09½- .10
Hematine crys., bbl	lb.	.14 - .18
Hemlock, 25% tannin, bbl	lb.	.03½- .04
Hypernic, solid, drums	lb.	.24 - .26
Hypernic, liquid, 51°, bbl	lb.	.09½- .10½
Logwood, crys., bbl	lb.	.14 - .15
Logwood, liq., 51°, bbl	lb.	.08 - .09
Osage Orange, 51°, liquid, bbl	lb.	.07 - .08
Osage Orange, powder, bg	lb.	.14 - .15
Quebracho, solid, 65% tannin, bbl	lb.	.05 - .05¼
Sumac, dom., 51°, bbl	lb.	.06½- .07½

Dry Colors

Blacks-Carbongas, bags, f.o.b. works, contract	lb.	$0.07½- $0.09
spot, cases	lb.	.11 - .15
Lampblack, bbl	lb.	.12 - .40
Mineral, bulk	ton	35.00 - 45.00
Blues-Bronze, bbl	lb.	.40 - .43
Prussian, bbl	lb.	.40 - .43
Ultramarine, bbl	lb.	.08 - .35
Browns, Sienna, Ital., bbl	lb.	.06 - .14
Sienna, Domestic, bbl	lb.	.03½- .04
Umber, Turkey, bbl	lb.	.04 - .04½
Greens-Chrome, C.P.Light, bbl	lb.	.28 - .30
Chrome, commercial, bbl	lb.	.12 - .12½
Paris, bulk	lb.	.26 - .28
Reds, Carmine No. 40, tins	lb.	4.50 - 4.70
Iron oxide red, casks	lb.	.10 - .16
Para toner, kegs	lb.	1.00 - 1.10
Vermilion, English, bbl	lb.	1.20 - 1.25
Yellow, Chrome, C.P. bbls	lb.	.16½- .17½
Ocher, French, casks	lb.	.02½- .03

Waxes

Bayberry, bbl	lb.	$0.25 - $0.26
Beeswax, crude, Afr. bg	lb.	.22½- .23
Beeswax, refined, light, bags	lb.	.32 - .34
Beeswax, pure white, cases	lb.	.40 - .41
Candellila, bags	lb.	.23 - .23½
Carnauba, No. 1, bags	lb.	.38 - .40
No. 2, North Country, bags	lb.	.27½- .28
No. 3, North Country, bags	lb.	.21½- .22
Japan, cases	lb.	.22 - .23
Montan, crude, bags	lb.	.05½- .06
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.05½- ....
Crude, scale 124-126 m.p. bags	lb.	.05 - .05¼
Ref., 118-120 m.p., bags	lb.	.05¼- .05½
Ref., 123-125 m.p., bags	lb.	.05½- ....
Ref, 128-130 m.p., bags	lb.	.05¾- ....
Ref., 133-135 m.p., bags	lb.	.05¾- ....
Ref., 135-137 m.p., bags	lb.	.06 - ....
Stearic acid, sgle pressed, bags	lb.	.11½- .11¾
Double pressed, bags	lb.	.11¾- .12
Triple pressed, bags	lb.	.13½- .13¾

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 - $7.75
Ammonium sulphate, bulk f.o.b. works	100 lb.	2.90 -.......
Blood, dried, bulk	unit	4.10 - 4.15
Bone, raw, 3 and 50, ground	ton	26.00 - 28.00
Fish scrap, dom., dried, wks	unit	..... -.......
Nitrate of soda, bags	100 lb.	2.52½- ....
Tankage, high grade, f.o.b. Chicago	unit	2.50 - 2.60
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.30 - 4.20
Tennessee, 75%	ton	7.00 - 7.25
Potassium muriate, 80%, bags	ton	34.55 -.......
Potassium sulphate, bags basis 90%	ton	45.85 -.......
Double manure salt	ton	27.00 -.......
Kainit	ton	7.22 -.......

Crude Rubber

Para—Upriver fine	lb.	$0.18 -.......
Upriver coarse	lb.	.14½-.......
Upriver caucho ball	lb.	.16½-.......
Plantation—First latex crepe	lb.	.22 -.......
Ribbed smoked sheets	lb.	.21½-.......
Amber crepe No. 1	lb.	.21½-.......

Gums

Copal, Congo, amber, bags	lb.	$0.10 - $0.15
East Indian, bold, bags	lb.	.20 - .21
Manila, pale, bags	lb.	.19 - .20
Pontinak, No. 1 bags	lb.	.19 - .20
Damar, Batavia, cases	lb.	.26 - .27
Singapore, No. 1, cases	lb.	.31 - .32
Singapore, No. 2, cases	lb.	.21½- .22
Kauri, No. 1, cases	lb	.62 - .64
Ordinary chips, cases	lb.	.20½- .21½
Manjak, Barbados, bags	lb.	.08 - .11

Shellac

Shellac, orange fine, bags	lb.	$0.60 - ....
Orange superfine, bags	lb.	.62 - ....
A. C. garnet, bags	lb.	.57 - ....
Bleached, bonedry	lb.	.68 - .69
Bleached, fresh	lb.	.58 - ....
T. N., bags	lb.	.59 - ....

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh ton	$300.00 - $400.00
Asbestos, shingle, f.o.b., Quebec	sh. ton	50.00 - 70.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 - 25.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	16.00 - 17.00
Barytes, grd., off-color, f.o.b. Balt	net ton	13.00 - 14.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	23.00 - 24.00
Barytes, crude f.o.b. mines, bulk	net ton	8.00 - 8.50
Casein, bbl., tech	lb.	.11 - .12
China clay (kaolin) crude, No. 1, f.o.b. Ga	net ton	7.00 - 8.00
Washed, f.o.b. Ga	net ton	8.50 - 9.00
Powd., f.o.b. Ga	net ton	14.00 - 20.00
Crude f.o.b. Va	net ton	6.00 - 8.00
Ground, f.o.b. Va	net ton	13.00 - 19.00
Imp., lump, bulk	net ton	15.00 - 20.00
Imp., powd	net ton	45.00 - 50.00
Feldspar, No. 1 f.o.b.N.C.	long ton	6.50 - 7.00
No. 2 f.o.b.N.C.	long ton	4.50 - 5.00
No. 1 soap	long ton	7.00 -.......
No. 1 Canadian, f.o.b. mill, powd	long ton	20.00 -.......
Graphite, Ceylon, lump, first quality, bbl	lb.	.05½- .06
Ceylon, chip, bbl	lb.	.04½- .05
High grade amorphous crude	ton	15.00 - 35.00
Gum arabic, amber, sorts, bags	lb.	.11 - .11½
Gum tragacanth, sorts, bags	lb.	.50 - .55
No. 1, bags	lb.	1.35 - 1.40
Kieselguhr, f.o.b. Cal	ton	40.00 - 42.00
F.o.b. N. Y.	ton	50.00 - 55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 - 15.00
Pumice stone, imp., casks	lb.	.03 - .35
Dom., lump, bbl	lb.	.05 - .05½
Dom., ground, bbl	lb.	.05 - .06
Silica, glass sand, f.o.b. Ind	ton	2.00 - 2.50
Silica, sand blast, f.o.b. Ind	ton	2.25 3.50
Silica, amorphous, 200-mesh, f.o.b. Ill	ton	20.00 -.......
Silica, glass sand, f.o.b. Ill	ton	1.75 - 3.00
Soapstone, coarse, f.o.b. Vt., bags	ton	7.50 - 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra	ton	10.00 -.......
Talc, 200 mesh, f.o.b. Ga., bags	ton	8.00 - 12.00
Talc, 325 mesh, f.o.b. New York, grade A bags	ton	14.75 -.......

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$4.00 - $4.50
Corning	bbl.	2.15 - ......
Cabell	bbl.	2.20 - ......
Somerset	bbl.	2.30 - 2.50
Illinois	bbl.	2.07 - ......
Indiana	bbl.	2.08 - ......
Kansas and Okla. under 28 deg.	bbl.	1.00 - ......
California, 35 deg. and up	bbl.	1.40 - ......

Gasoline, Etc.

Motor gasoline steel bbls	gal.	$0.20 - ......
Naphtha, V. M. & P. deod, steel bbls	gal	.19 - ......
Kerosene, ref. tank wagon	gal.	.15 - ......
Bulk, W.W. delivered, N.Y.	gal.	.08½- .09
Lubricating oils:		
Cylinder, Penn., filtered	gal.	.32 - .38
Bloomless, 30@31 grav	gal.	.20 -.......
Paraffin, pale	gal.	.18 - .18½
Spindle, 200, pale	gal.	.22 -.......
Petrolatum, amber, bbls	lb.	.04 - .04½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140-$145
Chrome brick, f.o.b. Eastern shipping points	ton	45-47
Chrome cement, 40-50% Cr_2O_3	ton	23-27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	42-45
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	35-38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65-68
9-in. arches, wedges and keys	ton	80-85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	50-53
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	50-53
F.o.b. Mt. Union, Pa.	1,000	42-45
Silicon carbide refract. brick, 9-in.	1,000	1180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y.	ton	$200.00 - ......

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30 –	....
4-6% C	lb.	.10½–	....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	107.50 –	....
Spiegeleisen, 19-21% Mn	gr. ton	38.00 –	40.00
Ferromolybdenum, 50-60% Mo, per lb. Mo.	lb.	2.00 –	2.50
Ferrosilicon, 10-12%	gr. ton	41.50 –	46.50
50%	gr. ton	75.00 –	80.00
Ferrotungsten, 70-80%, per lb. of W	lb.	.89 –	.91
Ferro-uranium, 35-50%, o U, per lb. of U	lb.	4.50 –	....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	23.00
C.i.f. Atlantic seaboard	ton	19.50 –	22.00
Coke, fdry., f.o.b. ovens	ton	5.00 –	5.50
Coke, furnace, f.o.b. ovens	ton	4.00 –	4.25
Fluorspar, gravel, f.o.b. mines, Illinois	ton	23.50 –	....
Ilmenite, 52% TiO_2 Va.	lb.	.01½–	....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.44 –	.46
Manganese ore, chemical (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	....
Rutile, 95% TiO_2	lb.	.12 –	.15
Tungsten, scheelite, 60% WO_3 and over	unit	10.00 –	....
Tungsten, wolframite, 60% WO_3	unit	9.00 –	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	2.50
Vanadium pentoxide, 99%	lb.	2.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.13⅛–$0.13¼
Aluminum, 98 to 99%	lb.	.27 – .28
Antimony, wholesale, Chinese and Japanese	lb.	.12 – .12½
Nickel, 99%	lb.	.28 – .32
Monel metal, shot and blocks	lb.	.32
Tin, 5-ton lots, Straits	lb.	.51¼
Lead, New York, spot	lb.	.09
Lead, E. St. Louis, spot	lb.	.0870
Zinc, spot, New York	lb.	.0665
Zinc, spot, E. St. Louis	lb.	.0630
Silver (commercial)	oz.	.64
Cadmium	lb.	.70–.75
Bismuth (500 lb. lots)	lb.	2.35
Cobalt	lb.	2.50-3.00
Magnesium, ingots, 99%	lb.	.90–.95
Platinum	oz.	120.00
Iridium	oz.	275.00–300.00
Palladium	oz.	83.00
Mercury	75 lb.	68.00–69.00
Tungsten	lb.	.95–1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	20.25
Copper bottoms	30.25
Copper rods	20.75
High brass wire	18.75
High brass rods	16.00
Low brass wire	20.50
Low brass rods	21.00
Brazed brass tubing	24.50
Brazed bronze tubing	25.75
Seamless copper tubing	23.75
Seamless high brass tubing	22.50

OLD METALS—The following are the dealers purchasing prices in cents per pound

Copper, heavy and crucible	11.50 @ 12.00
Copper, heavy and wire	11.00 @ 11.25
Copper, light and bottoms	9.00 @ 9.25
Lead, heavy	7.87½ @ 8.12½
Lead, tea	6.00 @ 6.25
Brass, heavy	6.00 @ 6.25
Brass, light	5.00 @ 5.25
No. 1 yellow brass turnings	7.00 @ 7.25
Zinc scrap	4.00 @ 4.25

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.54	$3.54
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.64	3.64

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Enameled Products Corp., 439 Lafayette St., New York, manufacturer of sanitary fixtures and other enameled ware, is said to be perfecting plans for a new local branch plant. A building has been leased on Ave. A, near 22nd St., to be remodeled and equipped for early occupancy. J. A. Turlin is president.

HOLT—The Central Iron & Coal Co. has plans for the construction of an addition to its local No. 3 foundry, used for the production of cast-iron pipe, etc., to be equipped to give employment to about 400 operatives. Work will be commenced at an early date.

California

LOS NIETOS—The Pacific Clay Products Co., manufacturer of fireproofing products, terra cotta, etc., has work in progress on additions to its local plant for considerable increase in production. The main 1-story building will be extended to a size 200x900 ft., and six new kilns constructed. The expansion will cost about $150,000, including equipment. William Lacy is president.

PASADENA—The Vitalait Laboratories, South Fair Oaks Ave. near Valley St., has plans under way for the erection of a new 1-story addition, 55x70 ft. and will take bids at an early date. Cyril Bennett and H. Haskell, 600 Security Bldg., Los Angeles, are associated architects.

YUBY CITY—The Valley Concrete Pipe Co., is arranging for expansion in its different plants and has increased its capital to $100,000. The company will be known in the future as the Valley Concrete Pipe & Products Co. The present plant at Van Nuys, Calif., will be dismantled and consolidated with the works at Chico, Calif., while it is planned to expand and continue the plant at Gridley, Calif.

Delaware

WILMINGTON—The Ford-Rennie Leather Co., Greenhill Ave. and 4th St., has tentative plans under advisement for the rebuilding of the portion of its plant destroyed by fire, March 16, with loss estimated at $175,000, including equipment. A large portion of the damage occurred in the beam house and main tannery, 1-story, 300x500 ft. John D. Rennie is one of the heads of the company.

Illinois

CHICAGO—The National Glass Co., 707 Blue Island Ave., has acquired property at Warren Ave. and Paulina St., heretofore held by the Midland Metal Co., consisting of 1- and 3-story buildings on a plot of about 27,000 sq.ft. of land, and will use for expansion. Possession will be taken at an early date and equipment installed.

CHICAGO—The Columbia Metal Co., 2719 Roosevelt Rd., has completed plans for a 1-story plant at Fairfield and Taylor Sts., 50x55 ft., and will commence erection at an early date. Dubin & Eisenberg, 14 West Washington St., are architects.

Indiana

INDIANAPOLIS—A controlling interest in the Perfection Paint & Color Co., 715 East Maryland St., has been acquired by F. B. Gable and A. E. Strickland, who will reorganize the company. Plans are being considered for extensions and improvements in the works, including additional equipment. Mr. Gable will be president of the new company, and Mr. Strickland, secretary and treasurer.

Kansas

TOPEKA—The Prairie Oil & Gas Co. is reported to have plans under way for the construction of a new oil-refining plant on property near the city, estimated to cost in excess of $150,000.

Kentucky

LOUISVILLE—The Dosch Chemical Co., Bernheim Lane and 7th St., is planning for the rebuilding of the portion of its plant, destroyed by fire on March 13, with loss estimated at about $15,000.

Maine

VAN BUREN—The International Paper Co., 100 East 42nd St., New York, has closed down its local pulp mill, and is reported to be considering plans for the conversion of the plant into a paper mill, installing necessary machinery for this purpose.

RUMFORD FALLS—The Oxford Paper Co. has completed plans for the erection of a new addition to its local mill, and will commence work at an early date. It is expected to cost in excess of $150,000, including equipment.

Maryland

BALTIMORE—The Locke Insulator Corp., Charles and Cromwell Sts., manufacturer of porcelain insulators for electric line service, etc., has awarded a general contract to J. Henry Miller, Inc., Eutaw St., for the erection of two 1-story additions, comprising a main manufacturing works, 80x380 ft., and kiln building, 50x411 ft. Work will begin at once.

AMCELLE—The American Cellulose & Chemical Mfg. Co. is pushing construction on a series of nine plant units for the manufacture of artificial silk, and plans to have the plant ready for operation early in the summer. It will be equipped for the employment of about 1,500 operatives.

Massachusetts

CHELSEA—The Thomas Strahan Co., Heard and Maple Sts., manufacturer of wall papers, has construction in progress on a new 1-story and basement addition, 60x100 ft., and plans to install equipment at an early date. The W. H. Whitcomb Construction Co., 6 Beacon St., Boston, is the general contractor. Charles T. Main 200 Devonshire St., Boston, is architect.

MALDEN—The Potter Drug & Chemical Co. has awarded a general contract to the W. H. Whitcomb Construction Co., 6 Beacon St., Boston, for the erection of a 2-story building at its plant, 55x65 ft. Robert H. Wambolt, same address, Boston, is architect.

Michigan

DETROIT—The Wolverine Porcelain & Enamel Co., 3351 Scotten Ave., is completing plans and will soon break ground for the erection of its proposed addition, to be 1-story, 80x120 ft., to be equipped for general production.

NEGAUNEE—The Pure Mfg. Co., manufacturer of fruit concentrates, etc., is said to be planning for the installation of additional equipment, including pulverizing equipment, drying tables, etc. E. S. White is chemist and general manager.

LANSING—The Superior Brass & Aluminum Casting Co., recently organized, has acquired property at 811 Jerome St., and will operate a plant for the production of aluminum, brass and bronze castings. It is expected to commence operations at an early date. C. H. Harb, formerly connected with the Michigan Brass & Iron Works, heads the new company. C. D. Coffman is also interested in the concern.

DETROIT—The Wise Electric Sherardizing Co., 6320 East Fort St., has completed plans and will commence the erection of a new 1-story plant, 70x215 ft., on Mount Elliott Ave., near Monroe St., to cost approximately $50,000, including equipment.

Minnesota

ST. PAUL—The Minnesota Mining & Mfg. Co., 791 Forest St., has awarded a contract to the George J. Grant Construction Co., Exchange Bank Bldg., for the erection of a 2-story addition, 80x160 ft., at Forest and Fauquier Sts., to cost about $65,000, including equipment. E. B. Ober is president.

Missouri

SPRINGFIELD—The Waite-Phillips Oil Co., Tulsa, Okla., is reported to be planning for the construction of a new oil storage and distributing plant on local site, estimated to cost close to $100,000.

ST. JOSEPH—The Missouri Rubber Products Co., Kirkpatrick Bldg., has awarded a general contract to the E. H. Lawson Construction Co., Edmond St., for the erection of its proposed plant on property acquired on 22nd St., consisting of two main buildings, estimated to cost $250,000, including equipment.

New Jersey

EAST BURLINGTON—The United States Cast Iron Pipe & Foundry Co., 71 Broadway, New York, will begin work at an early date on a number of new units at its local foundry, to be equipped for pipe production under the DeLavaud centrifugal process. The expansion will cost in excess of $200,000.

New York

TONAWANDA—The Spaulding Fibre Co., Wheeler St., has filed plans and will commence the immediate erection of an addition to its plant to cost approximately $130,000, including equipment.

BUFFALO—The Swan & Finch Co., 522 5th Ave., New York, manufacturer of lubricating oils, has acquired the M. & M. Oil Co., 20 Breckenridge St., specializing in similar refined oils. The new owner will consolidate with its organization in this section, and plans for expansion in operations. The purchasing company recently took over the N. B. Falls Oil Co., Inc., in this city.

BUFFALO—The Worthington Pump & Machinery Co., Roberts and Clinton Sts., will make extensions in the coke oven department at its local plant.

North Carolina

ASHEVILLE—The Uneka Mining Co., recently formed with a capital of $50,000, plans for the installation of a plant on ore properties in the western section of the state, to include hydraulic mining equipment, ore-washing machinery, air compressors and electric power apparatus. The initial plant will cost in excess of $65,000. James E. Rector, 11 Church St., Asheville, is attorney and represents the company.

Ohio

SANDUSKY—The Diamond Acid Products Co., recently organized with a capital of $50,000, is making ready to commence the erection of a new local plant on site in the East End district, near the works of the Diamond Fertilizer Co., with which the new organization is said to be affiliated. The plant will be equipped for the manufacture of sulphuric acid, with initial capacity of about 40 tons per day, and will represent an investment of about $100,000. It is understood that a contract for certain machinery has been awarded to the New Process Acid Co., 140 Nassau St., New York, and that orders for other apparatus will be placed in the near future.

TIFFIN—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron and clay sanitary ware, is completing plans for the erection of an addition to its local pottery to cost about $45,000, for which bids will soon be asked on a general contract. G. W. Netcher, 11½ South Washington St., Tiffin, is architect.

LEETONIA—The Cherry Valley Furnace, operating a local steel works, has plans for extensions and improvements, including a new gas-washer plant for reclaiming of gases from the furnace for re-use, additional boiler equipment and auxiliary apparatus. At a later date it is purposed to build a new 600-ton blast furnace.

Oklahoma

MUSKOGEE—The Hellams-Tummel Lime Co., 628 Elgin Ave., has commenced the construction of the first unit of a new plant for the production of calcium lime for chemical service, estimated to cost close to $65,000. It is purposed to build other units at a later date.

Pennsylvania

STROUDSBURG—The Tanite Co., manufacturer of emery products, compounds for valve grinding purposes, etc., has tentative plans under advisement for the rebuilding of the portion of its plant near the city limits, destroyed by fire, March 16, with loss estimated at $21,000, including equipment.

PHILADELPHIA—The Bihn & Wolff Co., Ash and Almond Sts., manufacturer of lamp black and kindred specialties, has awarded a general contract to F. Crompton & Co., for the erection of a new addition to cost about $30,000. It will be equipped for general production.

BRIDGEPORT—The Diamond State Fibre Co. has completed plans and will commence the erection of a 1-story addition, 60x250 ft., estimated to cost close to $75,000, including equipment.

Tennessee

CRAB ORCHARD—The Southland Portland Cement Co., 313 Independent Life Bldg., Nashville, Tenn., is perfecting plans for the erection of a new local plant on tract of property acquired some months ago. The initial unit will consist of a number of buildings, with power house, estimated to cost close to $1,000,000, with machinery. It will have a capacity in excess of 850,000 bbl. per annum. James O. Parker is president.

JACKSON—The Central Oil Mill Co. has preliminary plans under consideration for the rebuilding of its local plant, recently partly destroyed by fire with loss estimated at $120,000, including machinery. The reconstruction will cost approximately a like amount.

Texas

MEXIA — The Western Agricultural Chemical Co. has plans nearing completion for the construction of a local plant on site lately acquired for the manufacture of fertilizer products, to be 1-story, 140x250 ft., estimated to cost $80,000, with machinery. V. G. Dawson is construction engineer in charge.

GROESBECK—The Humble Oil & Refining Co., Houston, Tex., has plans for the rebuilding of the portion of its local storage and distributing plant, recently destroyed by fire with loss estimated at $75,000.

West Virginia

FAIRMONT—The West Virginia Chemical Co., Professional Bldg., W. C. McAdoo, manager, is said to have plans nearing completion for the erection of a 1-story addition to its local plant, estimated to cost approximately $45,000, including equipment.

Wisconsin

WEST BEND—The Amity Leather Products Co. will soon take bids for the erection of a 1-story plant on local site for tanning and other service, estimated to cost $45,000. Lockwood, Greene & Co., 38 South Dearborn St., Chicago, Ill., are architects.

New Companies

ARKITE CHEMICAL CO., Charleston, W. Va.; chemicals and chemical byproducts; $100,000. Incorporators: H. L. Carney and W. B. Brooks, Jr., both of Charleston.

EASTERN DEHCO ENAMELING CO., Brookline, Mass.; to operate a metal enameling plant; $50,000 Joseph M. Duffy, 28 Lakeview Ave., Braintree, Mass., is president and treasurer.

UNITED STATES COLOR CO., 29 South La Salle St., Chicago, Ill.; chemicals, colors, etc.; 200 shares of stock, no par value. Incorporators: Emil M. Lofland, C. H. Pease and Morgan R. Evans.

APICA MFG. CO., New York; chemicals, compounds, etc.; $25,000. Incorporators: G. A. Kubler and L. Roon. Representative: J. J. Lewin, 1328 Broadway, New York.

ROTAN CEMENT PLASTER CO., Rotan, Tex.; cement plaster and kindred products; $100,000. Incorporators: T. E. Lee and W. W. Barron, both of Rotan. Work is under way on a new local mill.

UNITED STATES SAPOLINE CO., 463 Larned St., Detroit, Mich.; washing fluids, cleansing compounds, etc.; nominal capital $5,000. Incorporators: Carman J. Young, Nathaniel Wilson and A. Clare Dunlop.

INDIANA MINERAL PRODUCTS CO., Wheatfield, Ind.; paint pigments, paints and kindred products; $100,000. Incorporators: William O. Kruger, David A. Bennett and Ezra H. Stewart, all of Wheatfield.

ASTRAL LABORATORIES, INC., Newark, N. J.; chemical products and chemical research operations; 1,000 shares of stock, no par value. Incorporators: Conrad Frey and Otto P. Scher, 437 Riverside Ave., Newark. The last noted represents the company.

WOOD FIBRE PRODUCTS CO., 122 South Michigan Ave., Chicago, Ill.; fiber specialties; $200,000. Incorporators: Charles H. Leinert, Lawrence L. Drumheller and Louis Nieland.

THOMAS PAPER CONVERTING CO., care of the Corporation Service Co., Equitable Bldg., Wilmington, Del., representative; $100,000; paper products.

BAY STATE SHEET COPPER CO., Boston, Mass.; copper and other metals; $100,000. Lloyd C. Nichols is president; and John H. Gilbert, 11 Baker St., West Roxbury, Mass., treasurer.

XIMENES OIL & REFINING CO., Floresville, Tex.; refined petroleum products; $40,000. Incorporators: G. E. Fuller and L. L. Crosby, both of Floresville.

MUSKOGEE CHEMICAL MFG. CO., Muskogee, Okla.; chemical specialties; $25,000. Incorporators: R. A. Patterson, Muskogee, and associates. Mr. Patterson will be president of the company.

WALES GRANULES CO., New York; chemical products; 1,000 shares of stock, no par value. Incorporators: W. C. and J. H. Wales, and J. F. Hulbert. Representative: J. O. Foote, 51 Chambers St., New York.

ELGIN OIL CO., North State St. and Highland Ave., Elgin, Ill.; refined oil products; $25,000. Incorporators: Harry G. Hempstead, M. M. Andrews and Louis Rockwell.

AN-MO-GOL OIL & CHEMICAL CO., 156 Market St., Newark, N. J.; organized; chemicals and chemical byproducts; oils, etc. Albert A. Rosch, 25 Franklin St., heads the company.

SALAMANCA MIRROR WORKS, INC., Salamanca, N. Y.; mirrors and other glass products; $50,000. Incorporators: W. O. and E. Frederickson, and T. McCabe. Representative: A. I. Krieger, Salamanca, N. Y., attorney.

TAYLOR-STICKLER REFINING CO., 190 North State St., Chicago, Ill.; refined oils, gasoline, etc. Incorporators: Jacob J. Stickler, Harry Cohen and Hugh E. Taylor.

COLCHESTER LEATHER NOVELTY CO., Colchester, Conn.; leather and rubber products; $15,000. Incorporators: Reuben Schuster and Charles F. Brown, both of Colchester.

UNION HYDRAULIC PLASTER CO., Pittsburgh, Pa.; lime, plaster, etc.; $15,000. R. L. Taylor, Midway, Pa., is treasurer and representative.

COLONIAL CEMENT FINISHING CO., New York; cement finishes, colors, etc.; nominal capital $5,000. Incorporators: R. Schonberg, F. Wald and R. B. Schiff. Representative: Shaine & Weinrib, 299 Broadway, New York.

BERG VARNISH CO., New York; paints, stains, varnishes, etc.; $35,000. Incorporators: S. H., J. E. and A. A. Berg. Representative: I. I. Berg, 1364 Ocean Parkway, Brooklyn.

NEW ENGLAND PORTLAND CEMENT & LIME CO., Rockland, Me.; cement, lime and kindred products; $1,000,000. A. L. Miles is president; S. T. Kimball, Rockland, Me., is clerk and representative.

Industrial Notes

L. O. KOVEN & BROTHER, INC., has taken over, as of Jan. 1, 1924, the copartnership business of L. O. Koven & Brother. The business will be conducted in the future under the same active management as heretofore.

THE ELYRIA ENAMELED PRODUCTS CO., of Elyria, Ohio, has appointed L. H. Evers Southern representative, with headquarters at Birmingham, Ala.

THE AMERICAN BEET SUGAR CO., at a meeting of directors held on March 18, elected the following officers: President and chairman of the board, R. Walter Leigh, to succeed Colonel H. Rieman Duval, deceased; vice-president and vice-chairman, Franklin Q. Brown; vice-president and treasurer, Charles C. Duprat; secretary and assistant treasurer, Charles E. Eller. Elisha Gee was continued as vice-president and auditor. Mr. Leigh, the new president of the company, is a member of the banking firm of Maitland, Coppell & Co. He has been a director and vice-chairman of the board for some time.